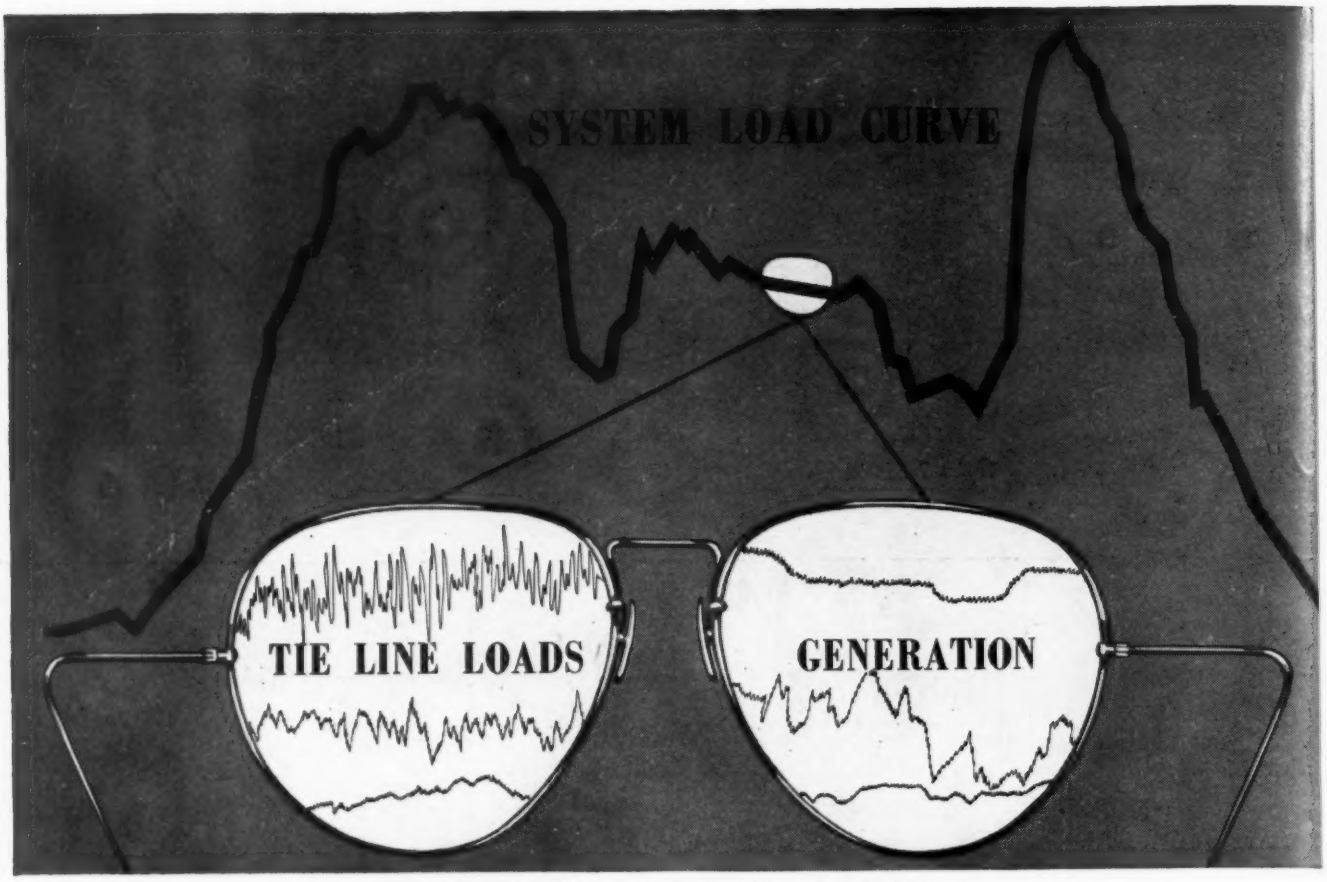
# POWER

MARCH
1946

GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

Hydro operation is big business in the Pacific Northwest where several huge plants harness the Columbia River, one of the world's great water-power sources. For a report on seven years' operating experie neville, with details of fl tion, repair of cavitat blades and results of the see article beginning on

ONTENT




# LOOK AT LOAD THROUGH THE DISPATCHER'S EYES

When the only load curve a dispatcher sees is plotted from periodic load readings, he does not get a true picture of routine operating conditions. He has to guess at what happens to load during the five or ten minute periods represented by straight sections of the plotted curve. And therefore the dispatcher often learns of critical load conditions so belatedly that the necessary resultant changes in generation upset the efficiency of the system.

To prevent this, the minimum information the dispatcher needs is a continuous record of the interchange on each tie, plus a continuous record of the output of each generating plant. This information is dependably supplied by Micromax Load Recorders. With these instruments, the dispatcher can see actual conditions when they exist—doe[illegible] depend on telephoned data. He can watch trends and an[illegible] He has a heavy responsibility, for opera[illegible]. Micromax Load R[illegible]ls to help discharge

Public Service Co. of Oklahoma uses this panel of Micromax Load Recorders, Frequency Recorder and L&N Load-Frequency Automatic Control, in the Load Dispatcher's office in Tulsa.

HRUP COMPANY, 4910 STENTON AVE., PHILA. 44, PA.

S & NORTHRUP

ERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

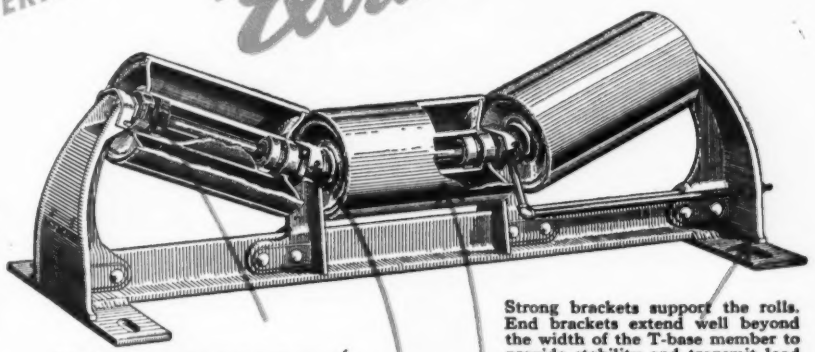
"The Engineer Review," "The Engineer," and "The Stationary Engineer"), March, 1946, Vol. nber in December. McGraw-Hill Publishing Company, Inc. Publications office, 99-129 North 0 West 42nd Street, New York 18, N. Y. Entered as second class matter August 25, 1936, at . A. Allow at least ten days for change of address. All communications about subscriptio est 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. P $5.00 for two years. All other countries $6.00 for one year. $9.00

IT'S THE ENGINEERING OF EACH PART THAT GIVES YOU THAT

## "Extra" in Service

● Top performance in belt conveyors depends, in great measure, on the structure on which the load moves. LINK-BELT Roller Bearing Belt Conveyor Idlers are the outgrowth of almost 50 years of constant development. Engineering that progressed to keep ahead of growing service needs has achieved outstanding design in today's LINK-BELT IDLERS.

You can depend on them, and there is every reason why, to require minimum power and maintenance — to perform smoothly and dependably and to add to the ordinary life of belts.



Interlocking nuts and yokes prevent brackets from spreading — the hexagonal end-nuts interlock with bracket yokes so that roll shafts actually tie all brackets together.

Strong brackets support the rolls. End brackets extend well beyond the width of the T-base member to provide stability and transmit load directly to rigid steel feet. Center brackets straddle the full width of the horizontal self-cleaning steel Tee-Bar.

POSITIVE GREASE SEAL keeps grease in and dirt out—conserves lubrication — prolongs bearing life. No springs, no loose parts, no sliding metal-to-metal contact.

Rolls are accurately aligned in a sturdy, streamlined frame assembled in jigs to assure correct bracket spacing and roll interchangeability.

●

**Book No. 1915 gives full particulars**

This 16-page book is packed with detailed information on LINK-BELT Belt Conveyor Idlers and the various types available in the "100" series. Drawings are shown with tables giving list prices, dimensions in inches, and weights in pounds. Write today for this book.

**LINK-BELT COMPANY**

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8, Pittsburgh 19, Cleveland 13, Detroit 4, New York 7

9061

**LINK-BELT**

THE SYMBOL OF QUALITY — LINK-BELT COMPANY

**BELT CONVEYOR EQUIPMENT**

IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • DRIVES

# cleaner, drier steam from

**Elimination of solids and moisture from steam leaving boiler drums, and an assurance of positive boiler water circulation, are accomplished with an unusual degree of effectiveness by the B&W Cyclone Steam Separator. Seven years of wide use in Babcock & Wilcox boilers have thoroughly proved the efficiency of the B&W Cyclone Steam Separator for the consistent and reliable production of clean, dry steam.**

## WHAT THE CYCLONE DOES:

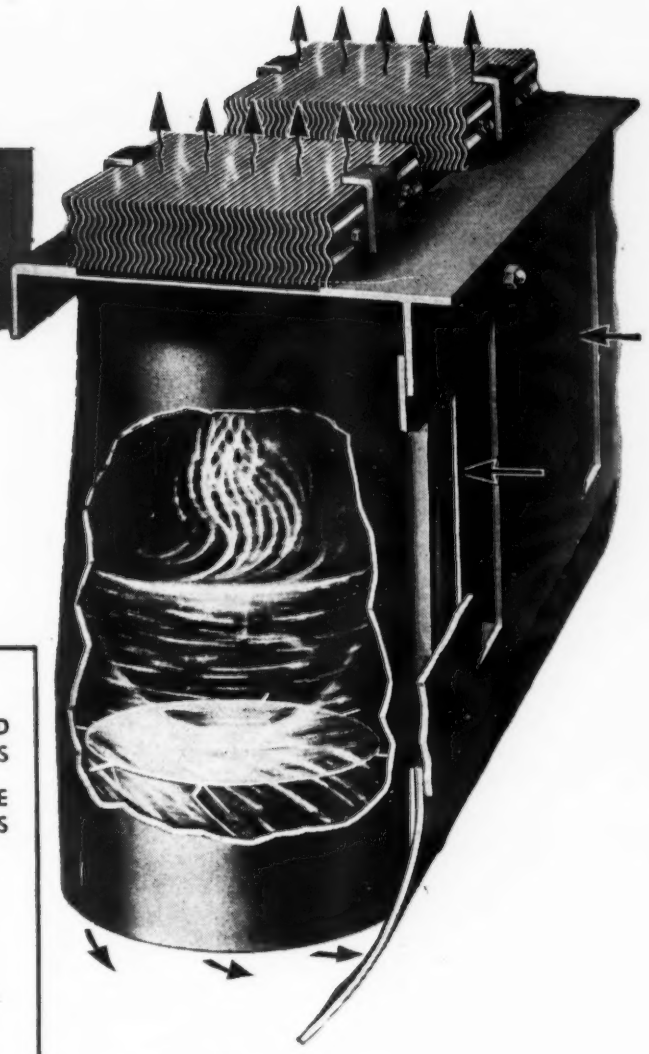
The separation of the water and its attendant solids from the steam is so nearly complete in the Cyclone Steam Separator that boiler and turbine performance are improved in many important ways:

1. Boilers can be operated at greater water-level variation without priming, making larger and more rapid load swings safely possible.
2. Complete separation of the steam from the water produces a maximum circulating head and delivers solid (steam free) water to the downcomers, thereby protecting boiler tubes against overheating and burnout.
3. Dry steam is assured over wider range in boiler water concentration.
4. Superheater tubes are protected from burnouts and failure due to scale deposits.
5. Longer periods of continuous boiler operation are secured.
6. Savings in maintenance time and expense are effected in boilers and turbines.
7. Safety is promoted by reducing variations between water levels in drum and gauge glass.
8. Turbine blades stay clean longer, permitting longer operating periods between cleanings.
9. Desired KW output can be maintained for longer periods.

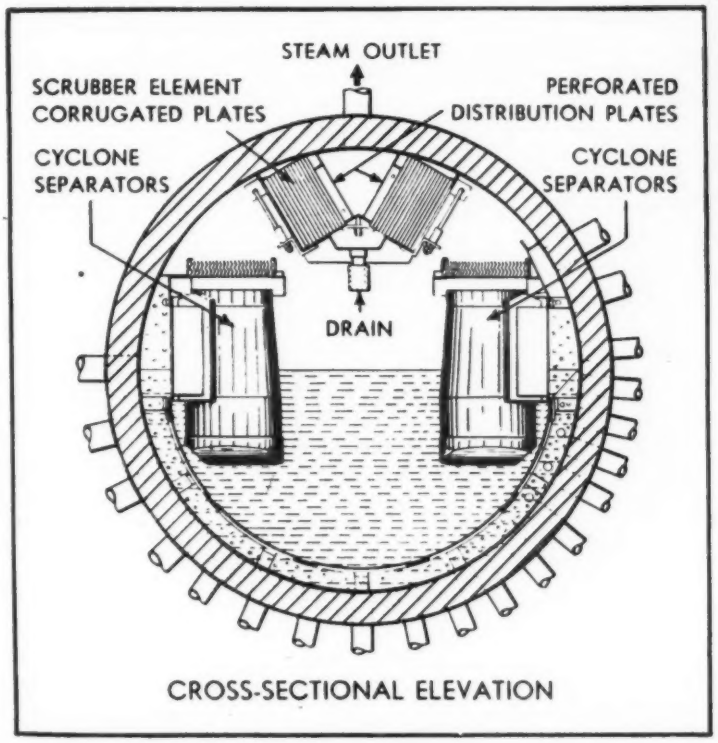
Separation of the water from the steam by the Cyclone Steam Separator is a continuous action. The kinetic energy of the steam and water mixture entering the Cyclone forces the water and any entrained impurities to the wall of the cylinder, while the nearly pure, dry steam passes out at the top between corrugated scrubber plates. The water swirls down the cylinder wall to the bottom, where kinetic energy is again utilized to force the water through directing vanes with sufficient velocity to overcome the head of water in the drum. The action within the separator prevents its flooding, and assures the delivery of clean, dry steam at all times.

The Cyclone Steam Separator is another B&W "first" in the development of better steam-generating equipment — another reason why it pays to *see B&W first* for the latest solution to any steam problem.

# a cyclone...



Cross section of typical Cyclone Steam Separator installation in a large boiler drum.




B&W Cyclone Steam Separator with section cut away to show functioning.

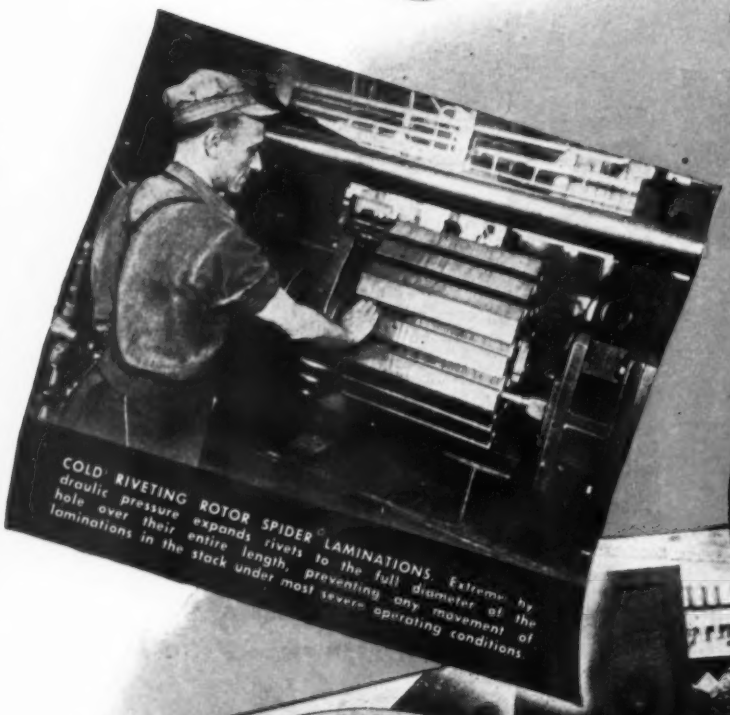

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
85 LIBERTY STREET, NEW YORK 6, N.Y.

G-184T

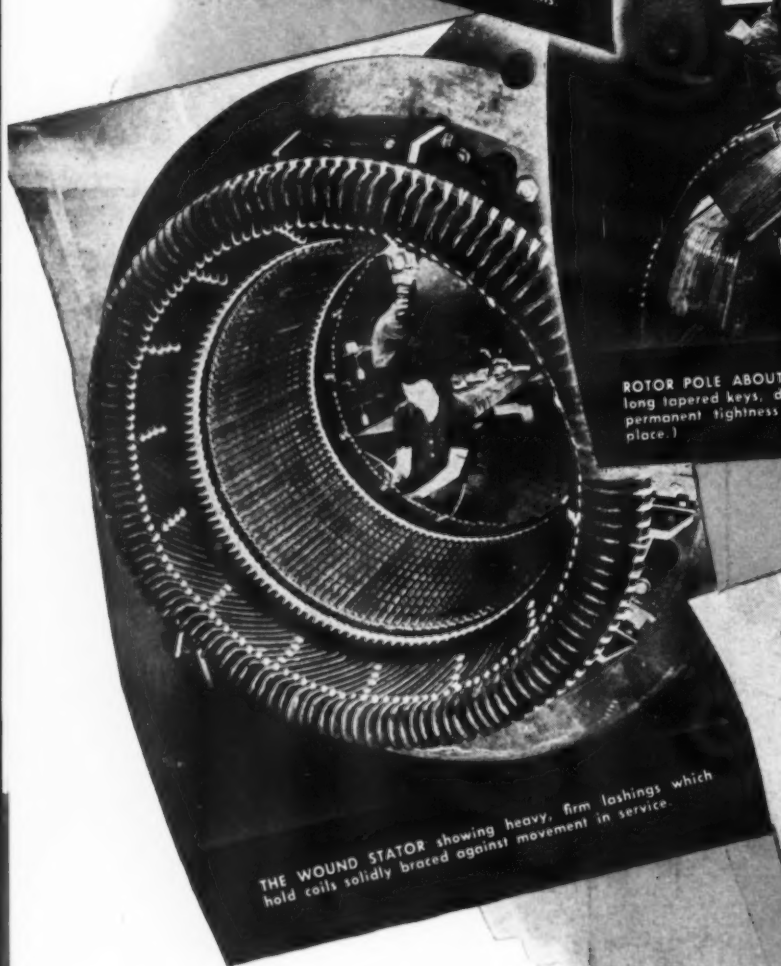
# Exceptional construction



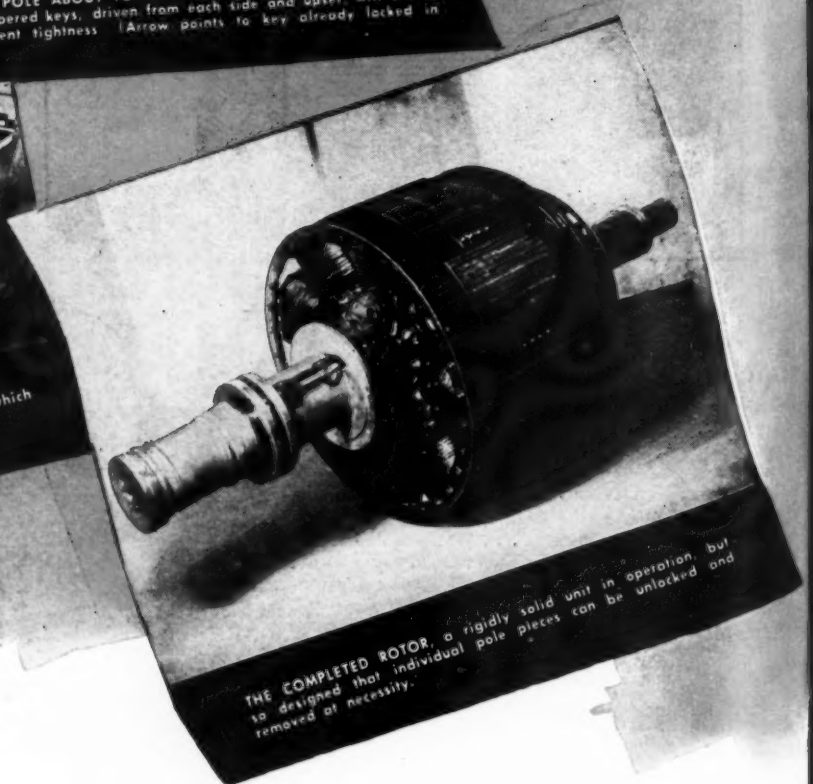
COLD RIVETING ROTOR SPIDER LAMINATIONS. Extreme hydraulic pressure expands rivets to the full diameter of the hole over their entire length, preventing any movement of laminations in the stack under most severe operating conditions.

ELLIOTT DIAMOND CAGE WINDING — heavy bars inserted in slots in the pole piece, joined to end ring segment by a silver brazing process in a permanent bond which tests out as stronger than the parent metal itself. The laminations of the pole piece are cold riveted together.

ROTOR POLE ABOUT TO SLIP INTO DOVETAILED SLOT, where long tapered keys, driven from each side and upset, will assure permanent tightness. (Arrow points to key already locked in place.)



THE WOUND STATOR showing heavy, firm lashings which hold coils solidly braced against movement in service.



THE COMPLETED ROTOR, a rigidly solid unit in operation, but so designed that individual pole pieces can be unlocked and removed at necessity.

# methods *that distinguish*

# MOTORS *by* ELLIOTT

You can easily "prettify" the outside appearance of a motor—but that won't affect the appearance of its performance record. Only sound construction will help there.

By **sound** construction we do not mean **expensive** construction. Some of the methods used in building Elliott motors cost little or no more than what may be called standard practice. Other procedure may run to definitely higher time outlay, with, however, a beneficial performance result that places the slightly higher overall cost in the category of a most profitable investment.

Elliott motors are custom-built, engineered with characteristic Elliott thoroughness. In their building, no expense is incurred which is not amply justified—and no time or trouble is spared which will further their long and faithful service. When you need a fine motor, closely adapted to a specific drive job, discuss it with Elliott. Informative bulletins at request.

**ELLIOTT COMPANY**

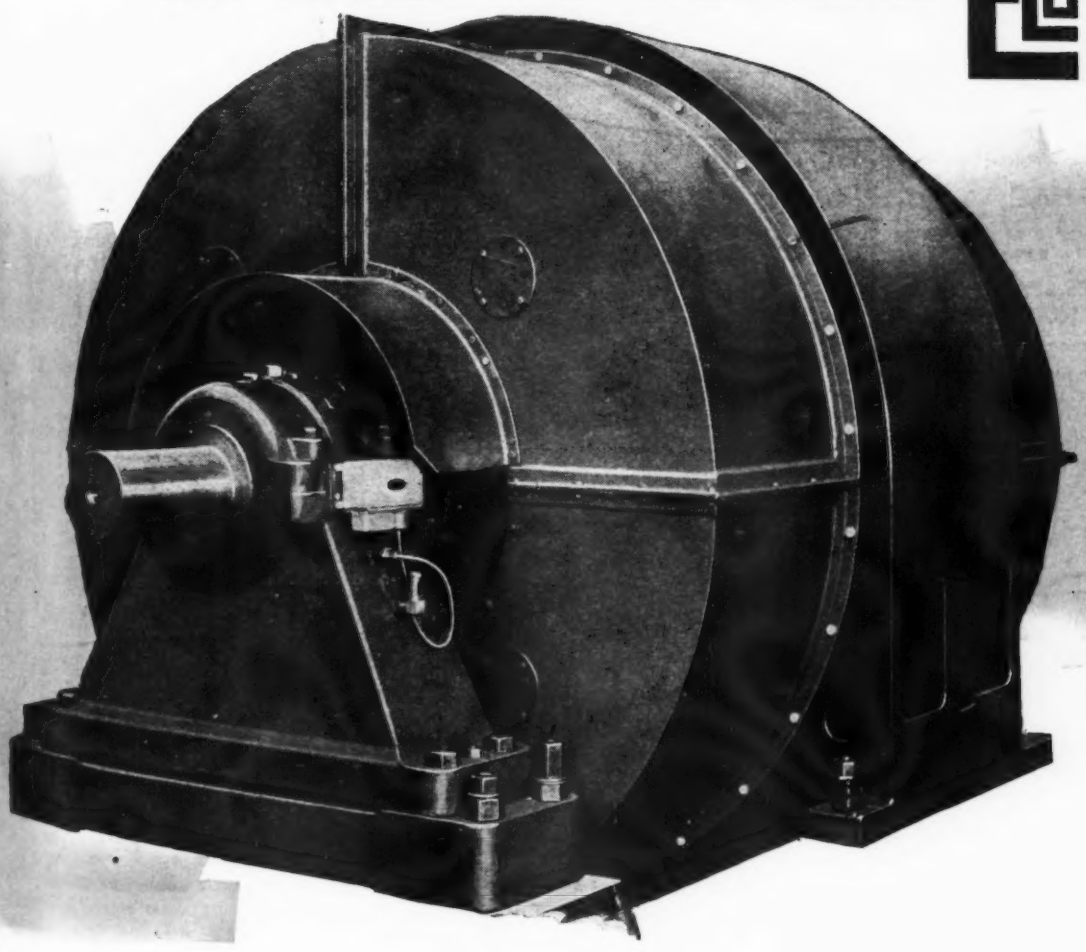
*Electric Power Dept.*, RIDGWAY, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.

*DISTRICT OFFICES IN PRINCIPAL CITIES*

STEAM TURBINES • GAS TURBINES • ELECTRIC GENERATORS AND MOTORS • BLOWERS AND COMPRESSORS • TURBOCHARGERS FOR DIESEL ENGINES • CONDENSERS • STEAM JET EJECTORS FILTERS • FEEDWATER HEATERS AND DEAERATORS • DESUPERHEATERS • TUBE CLEANERS • GREASE EXTRACTORS • SEPARATORS • STRAINERS • NONRETURN VALVES

L-765



**THIS TYPICAL ELLIOTT SYNCHRONOUS MOTOR** is one of a group built for a waterworks pump drive job in an important municipality. It is 1750-hp., 720-rpm, self-ventilated, with drip-proof construction. The methods used in its building have been developed by Elliott motor engineers over an extended period, and have each contributed to the outstanding success and high reputation attained by Elliott motors in a wide range of applications, many being exceptionally exacting and difficult. A few of these Elliott construction methods are illustrated on the facing page.

# DIAMOND AUTOMATIC SEQUENTIAL

When a boiler is equipped with Diamond Automatic Sequential Air Puff Soot Blowers, none of the situations you see illustrated at the right can happen. In the first place, there is no attendant because the entire soot blowing system is operated by simply opening a valve on master controller or by pushing a "start" button on a program panel which can be a part of the boiler and turbine control board.

Then, being automatically controlled, the soot blowers always operate in the same sequence and with the same blowing time. No blower unit can be overlooked or incorrectly operated. Should it ever be found necessary to change the blowing sequence, it is easily accomplished by a simple change on the master controller.

The compressed air—having a greater density than steam—provides theoretically better cleaning. The air is discharged from the element nozzles in a series of short puffs with substantial pauses between. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

This Diamond equipment has been in very successful central station use since 1940. For further information, write for Bulletin No. 956 which illustrates and describes an installation on a 900,000 lb/hr boiler in a modern eastern central station.

## *Other Features*

**SAVES LABOR**

—no attendant needed to drain piping, warm it up and operate each individual blower.

**NO FEED WATER MAKEUP**

—using compressed air instead of steam.

**SAVES FUEL**

—uses only ⅓ to ⅔ of energy from coal pile that is needed for steam blowing.

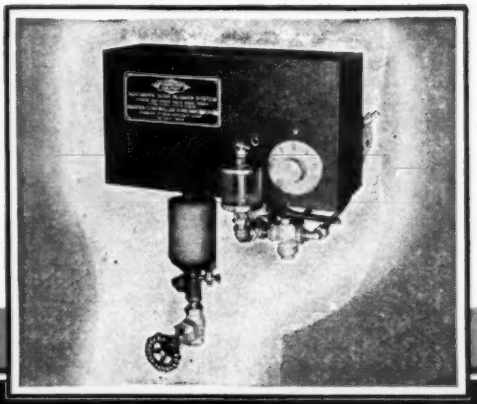
**ELIMINATES STACK DISCHARGE NUISANCE**

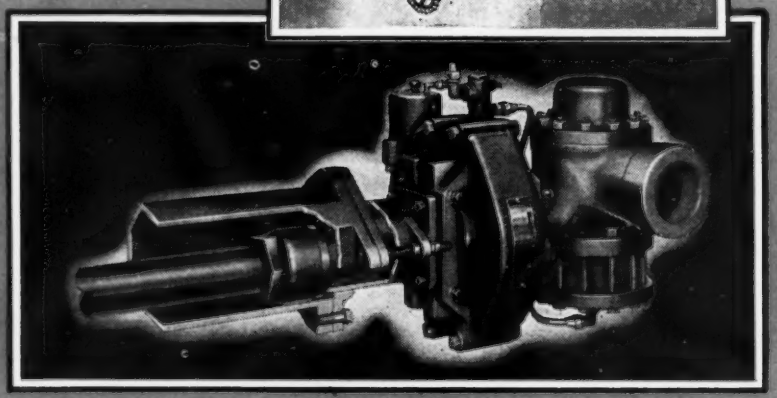
—intermittent operation expels soot from boiler in small quantities.

**REDUCES MAINTENANCE**

—experience on boilers in operation since 1940 proves maintenance unusually low.

(Right) Master Controller which automatically controls the sequence and blowing time of Diamond Air Puff Soot Blowers (see below) having elements permanently installed inside the setting.

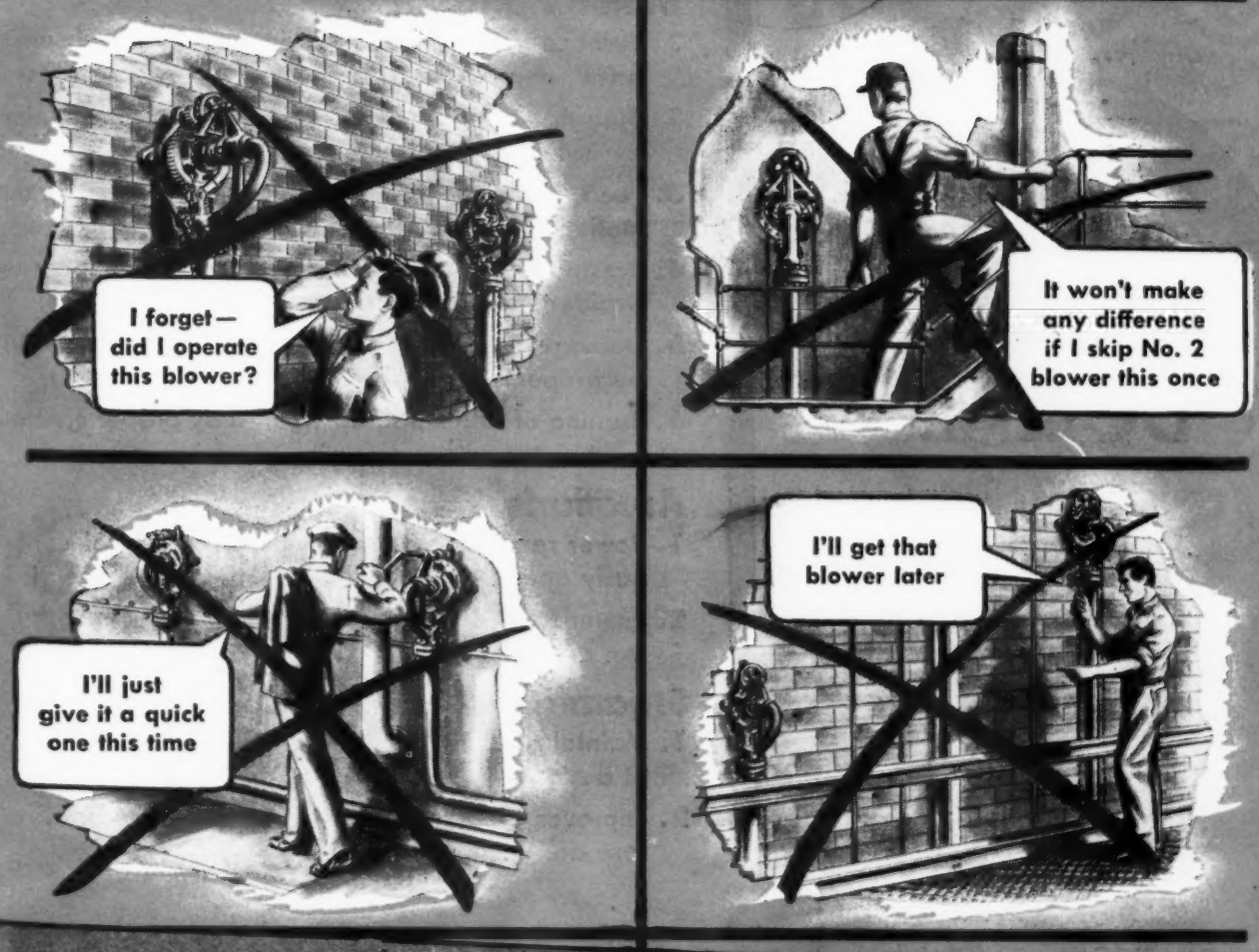




**DIAMOND POWER**

# "Air Puff" SOOT BLOWING

## Eliminates THE HUMAN ELEMENT and Assures CORRECT BOILER CLEANING


I forget— did I operate this blower?
It won't make any difference if I skip No. 2 blower this once
I'll just give it a quick one this time
I'll get that blower later

**SPECIALTY CORP.** DETROIT 31, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

# How BAILEY CONTROLS Save Money

### Fuel

1. Average saving as reported by users is 5%.
2. Waste fuel automatically used, when available, by Multi-Fuel firing.
3. Flexibility of control simplifies switching to most economical fuel.

### Maintenance

1. Furnace wall repairs reduced by limiting maximum furnace temperature through close control of excess air.
2. Slagging of heating surfaces reduced to a minimum by accurate control of excess air.
3. Feed water pumps protected at low ratings by automatic by-pass control.
4. Possible damage to turbine from water carry-over avoided by feed water control.
5. Damage from excessive steam temperature avoided by proper control of excess air and superheat.
6. Burning of tubes insured against by proper control of feed water and excess air.

### Auxiliaries

1. Power required by fans is less since control continuously operates on minimum allowable excess air.
2. Power for feed pumps may be reduced through control of excess pressure by pump speed.

### Steam Use

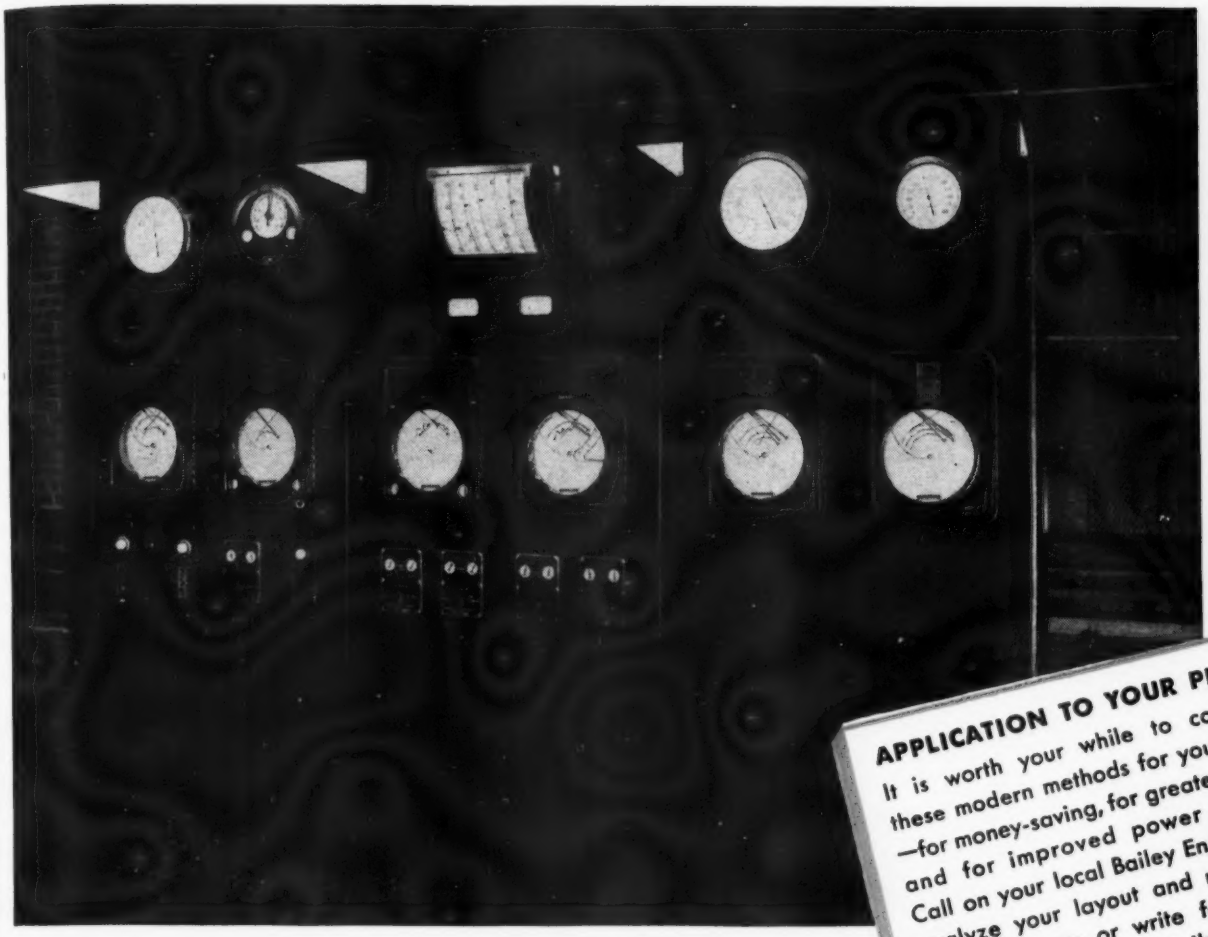
1. Maintains Prime Mover efficiency by supplying steam at design pressure and temperature.
2. Improves process operation by controlling flow, pressure and temperature.

**BAILEY METER COMPANY**

1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

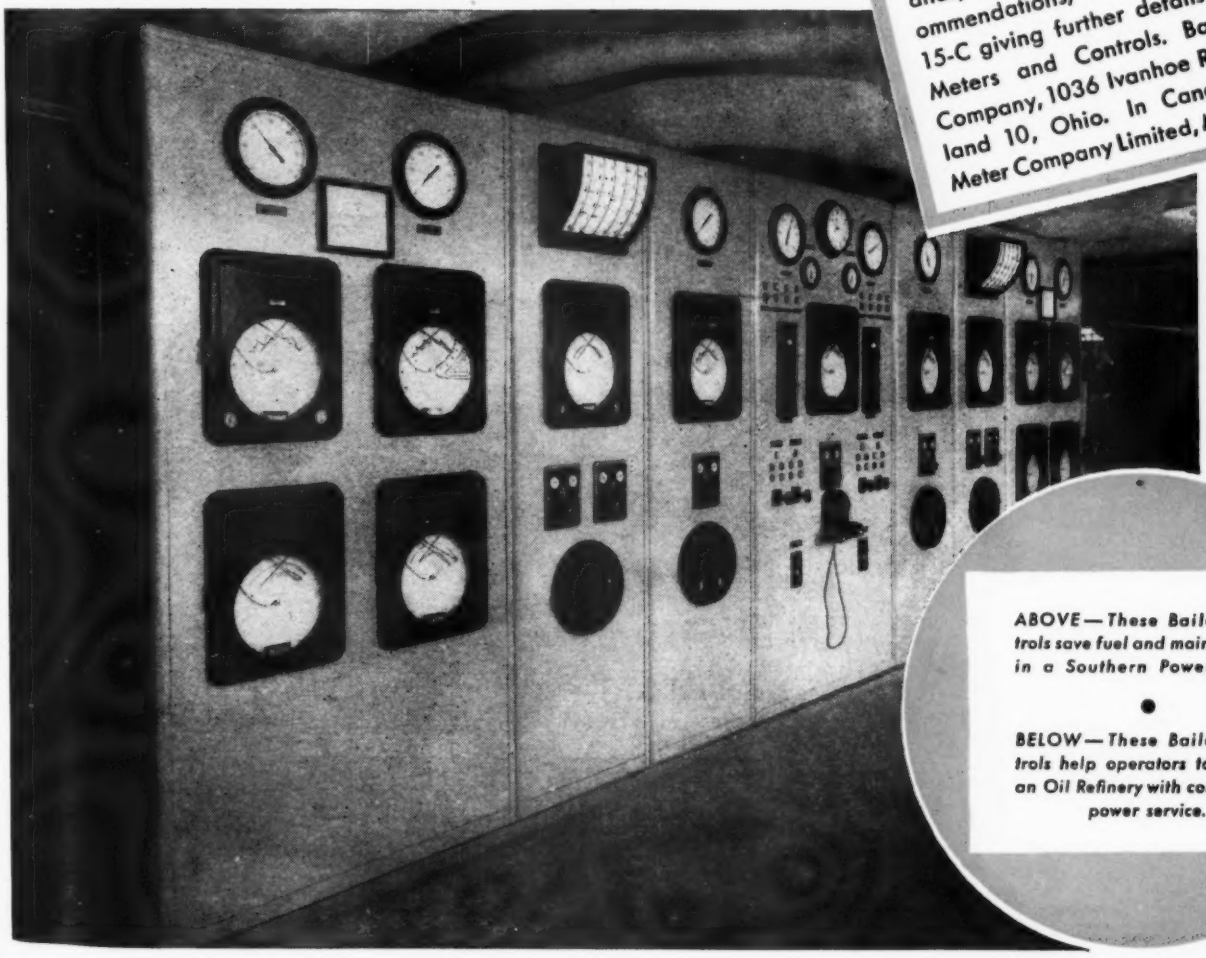
*Controls for Steam Plants*

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS



**APPLICATION TO YOUR PLANT**

It is worth your while to consider these modern methods for your plant —for money-saving, for greater safety and for improved power service. Call on your local Bailey Engineer to analyze your layout and make recommendations; or write for Bulletin 15-C giving further details on Bailey Meters and Controls. Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio. In Canada — Bailey Meter Company Limited, Montreal. A-92

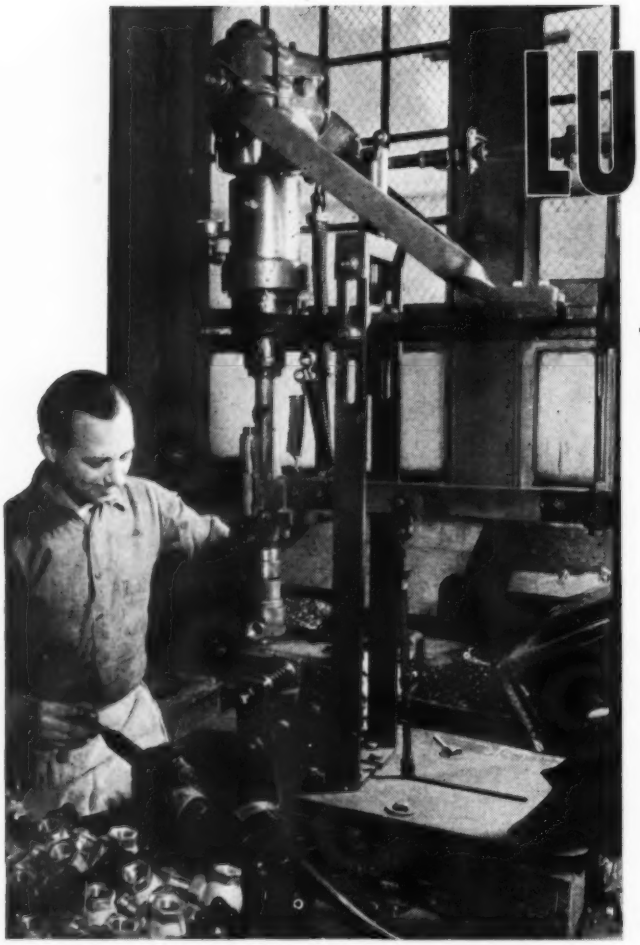


*ABOVE — These Bailey Controls save fuel and maintenance in a Southern Power Plant.*

●

*BELOW — These Bailey Controls help operators to supply an Oil Refinery with continuous power service.*

# LUNKENHEIMER



**ASSEMBLING REQUIRES NO SPECIAL FITTING**

● Assembling is greatly simplified by Lunkenheimer precision production . . . parts are so accurately made that special fitting isn't necessary.

Fig. 2125
Bronze
Double Disc
Gate

Fig. 1938
Cast Steel
Gate

Fig. 1430
Iron Body
Gate

Fig. 1640
"King-clip"
Gate

**BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES**
**125 TO 2500 LB. S. P. BOILER MOUNTINGS, LUBRICATING DEVICES**
**AIRCRAFT FITTINGS**

# *Precision Workmanship*

■ ■ ■

# SUPER-ACCURACY IN EVERY PART . . . LONGER SERVICE LIFE

● You can't fool maintenance men on valve quality. They know that when a valve has a much longer than average service life, that valve has superior accuracy and precision built into it from handwheel to pipe threads.

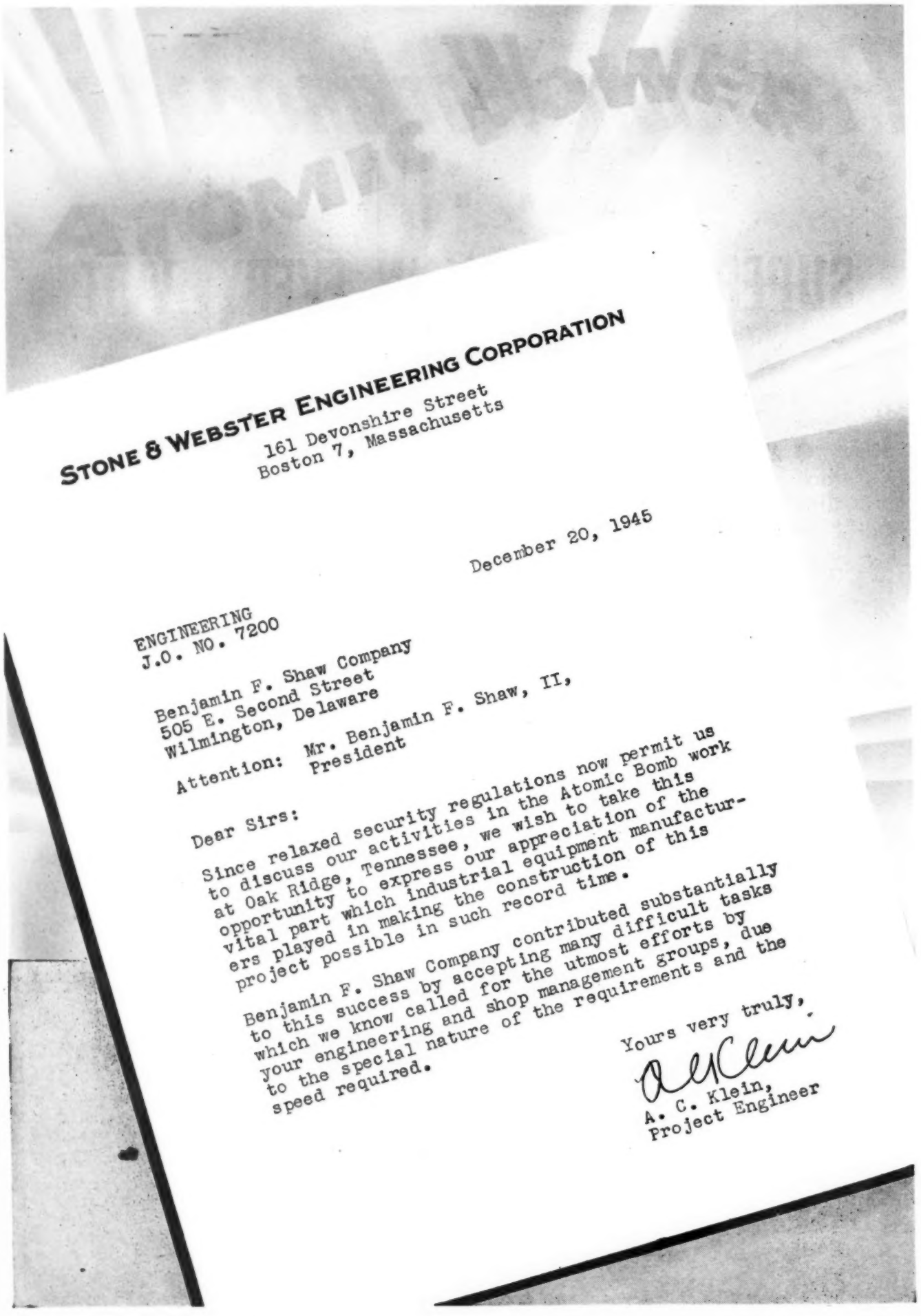
Such valves are the only kind that have ever been produced by Lunkenheimer. For more than three quarters of a century, the Lunkenheimer quality ideal has won ever widening acceptance until today it is a recognized tradition in American industry.

Lunkenheimer quality is the balanced combination of many factors. Among them are finest raw materials approved by constant testing and research . . . sound, advanced design . . . highly skilled workmanship...absolute accuracy...perfect alignment of all parts. As an inevitable result—wherever you find Lunkenheimer Valves you find maintenance cost records consistently lower.

The Lunkenheimer Co., Cincinnati 14, Ohio, U. S. A.
Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7.
Export Department: 319-322 Hudson St., New York 13, N. Y.

## Your LUNKENHEIMER Distributor

—is an important link in the nationwide Lunkenheimer chain of better, more efficient, more reliable valve service. He is fully equipped to assist in the solution of valve maintenance and operating problems. In addition, he can make prompt arrangements to have a Lunkenheimer Engineer call at the plant whenever technical valve engineering knowledge is required.



**STONE & WEBSTER ENGINEERING CORPORATION**

161 Devonshire Street
Boston 7, Massachusetts

December 20, 1945

ENGINEERING
J.O. NO. 7200

Benjamin F. Shaw Company
505 E. Second Street
Wilmington, Delaware

Attention: Mr. Benjamin F. Shaw, II,
President

Dear Sirs:

Since relaxed security regulations now permit us to discuss our activities in the Atomic Bomb work at Oak Ridge, Tennessee, we wish to take this opportunity to express our appreciation of the vital part which industrial equipment manufacturers played in making the construction of this project possible in such record time.

Benjamin F. Shaw Company contributed substantially to this success by accepting many difficult tasks which we know called for the utmost efforts by your engineering and shop management groups, due to the special nature of the requirements and the speed required.

Yours very truly,

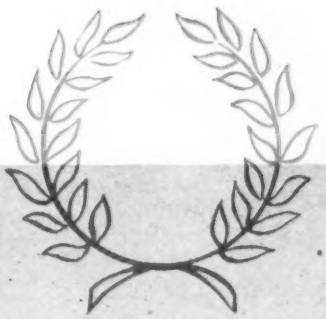
A. C. Klein,
Project Engineer

# such RECOGNITION
## MUST BE DESERVED

**Benjamin F. Shaw Co. is proud of the contribution it was able to make in the prefabrication and installation of piping in the famous Oak Ridge Atomic Bomb Plant. This performance is typical of the scope of tasks Shaw performs in the piping prefabrication, installation and erection field.**

**Benjamin F. Shaw Company is qualified to prefabricate and erect piping—any place in the United States and Canada.**

Alex. P. Shaw II
President

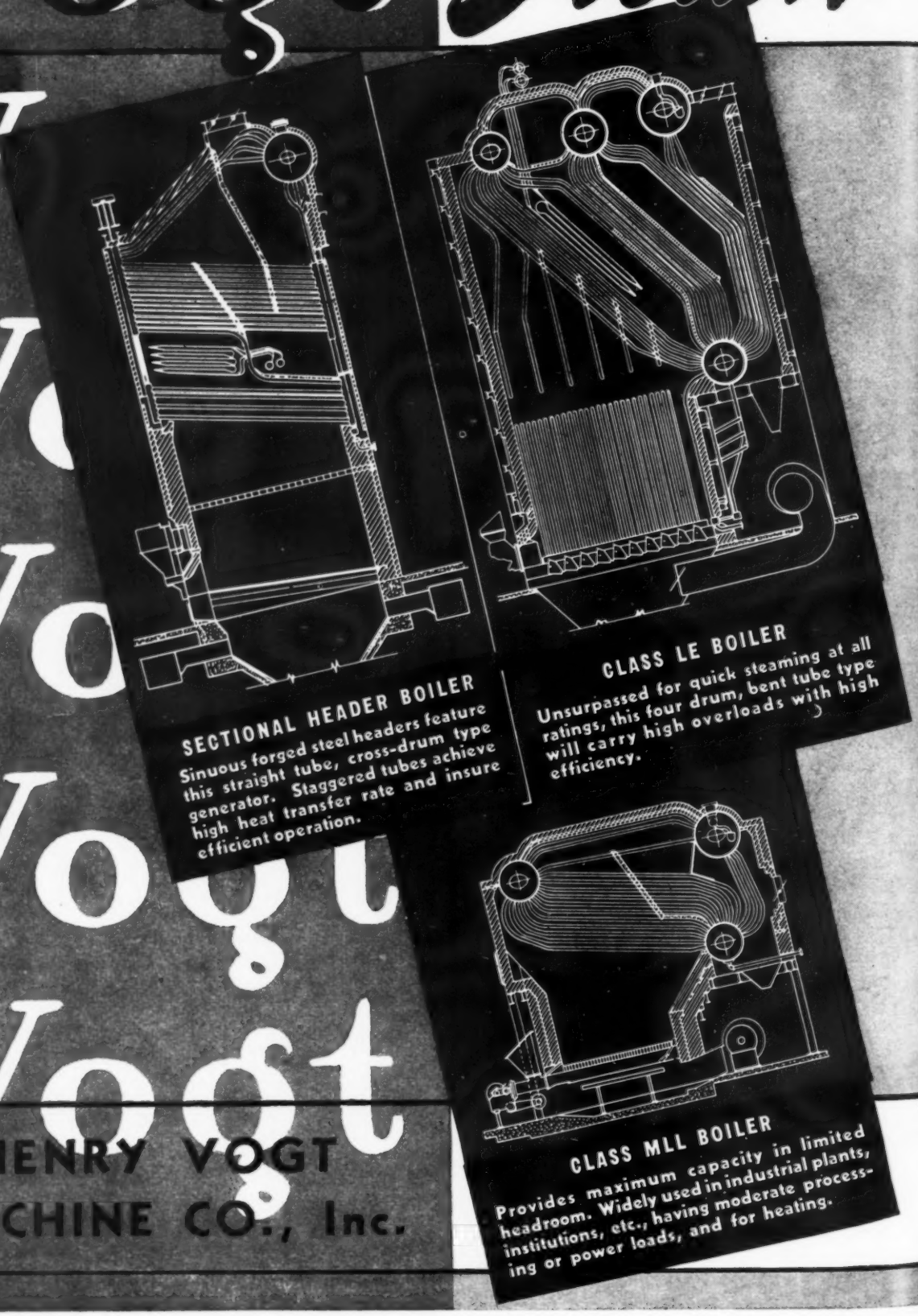


## BENJAMIN F. SHAW CO.

**2nd & Lombard Streets** **Wilmington 99, Delaware**

KNOWN SINCE 1893 FOR HIGH-QUALITY PRE-FABRICATION AND PIPING INSTALLATION

# Vogt Steam



**SECTIONAL HEADER BOILER**

Sinuous forged steel headers feature this straight tube, cross-drum type generator. Staggered tubes achieve high heat transfer rate and insure efficient operation.

**CLASS LE BOILER**

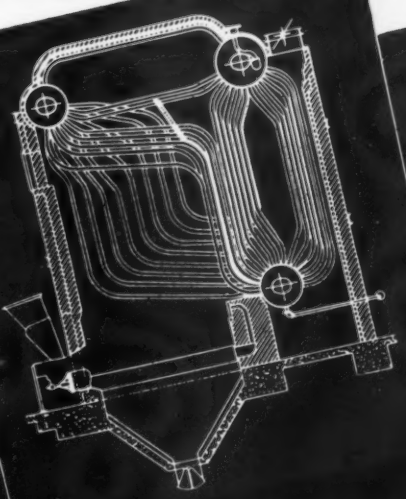
Unsurpassed for quick steaming at all ratings, this four drum, bent tube type will carry high overloads with high efficiency.

**CLASS MLL BOILER**

Provides maximum capacity in limited headroom. Widely used in industrial plants, institutions, etc., having moderate processing or power loads, and for heating.

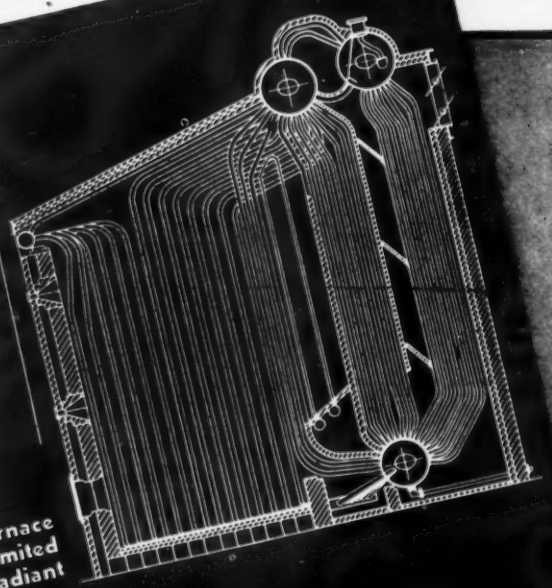
HENRY VOGT
MACHINE CO., Inc.

# GENERATING UNITS



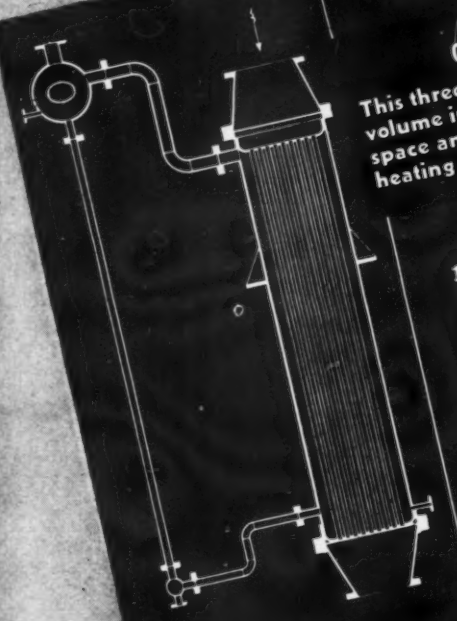
**CLASS VL BOILER**

This three drum design has large furnace volume in a unit which occupies limited space and provides high ratio of radiant heating surface.



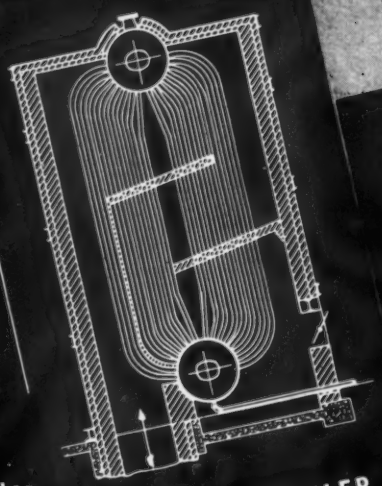
**CLASS VR BOILER**

An efficient, high-duty unit with water-cooled furnace for suspended fuel firing, such as powdered coal, oil, or gas.



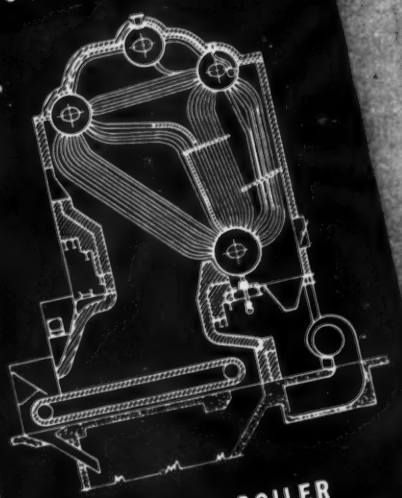
**REFINERY WASTE HEAT GENERATOR**

Shell and tube type designed to utilize high temperature gases from refinery processes such as those from catalytic units.



**WASTE HEAT BOILER**

A water-tube type which utilizes the heat in waste gases as produced by numerous industries. Designs will accommodate gases having high dust content.



**CLASS M BOILER**

This four drum, bent tube unit has the steam drum above the water level and delivers steam with 15°-18° superheat.

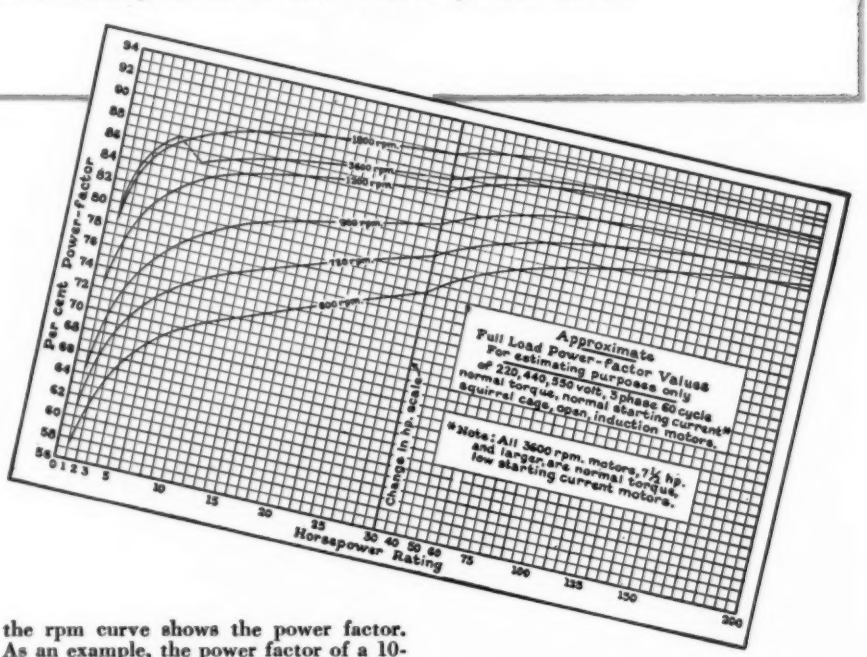
**1000 WEST ORMSBY STREET**
**LOUISVILLE 10, KENTUCKY**

**BRANCH OFFICES:** *New York • Chicago Cleveland • Philadelphia • Dallas*

# NO. 3

# Helpful Hints on Applying Capacitors

*To help you improve power factor, reduce kva demand, increase circuit loadability and, often, reduce power costs.*


Per cent Power-Factor
Horsepower Rating
Approximate
Full Load Power-Factor Values
For estimating purposes only
of 220, 440, 550 volt, 3 phase, 60 cycle
normal torque, normal starting current*
squirrel cage, open, induction motors.
*Note: All 3600 rpm. motors, 7½ hp. and larger, are normal torque, low starting current motors.
Leading
Lagging
Change in Line Current

## HOW CAPACITORS ARE APPLIED TO MOTORS TO IMPROVE POWER FACTOR

Improvement of power factor is often most effectively done by applying capacitors directly to the terminals of the individual motors, and switching motor and capacitor as a unit. As the "non-working" current (reactive kva) is then supplied on the spot, there is a reduction in the current flowing to the motor for any given load or overload. Therefore, it is important to make certain that there is adequate motor overload protection after the capacitors are applied.

In many cases it is necessary to change the heater units in the motor thermal relays on the basis of the reduced current of the motor-capacitor combination, as contrasted with the motor current alone.

When capacitors are connected to the motor terminals directly, and are switched with the motor, it is recommended that the capacitor kva be no more than is necessary to improve the power factor to approximately 95 per cent. Excessive capacitor kva may cause overvoltage on the motor during deceleration after the switch is opened.

## SHORT CUTS TO THE RIGHT CAPACITOR KVA

In applying capacitors, it is always possible to calculate exactly the correct kvar (kilovars) if the full-load power factor, the horsepower, the efficiency, and the kw load of the motor are all known. However, the short-cut method given here is a time saver, particularly when there are a number of cases to be worked out, and gives results accurate enough for most applications.

## POWER FACTOR

The above chart gives the power factor of any squirrel-cage motor, regardless of the manufacturer, accurately enough to show the possibilities for improvement by adding capacitors. The point where the horsepower line intersects the rpm curve shows the power factor. As an example, the power factor of a 10-hp, 1200-rpm motor is 84.5 per cent.

## CAPACITOR KVA (KILOVARS)

The table shows the standard capacitor kva ratings in kilovars recommended for use with various standard motors. For example, the 10-hp motor referred to would require a 4-kva capacitor. The table also shows, under the heading Per Cent AR, the resulting per cent reduction in line current and is helpful in choosing the proper heater unit for thermal overload relays located on the line side of the capacitor.

**Maximum capacitor rating when capacitor and motor are switched as a unit**

| Induction Motor HP Rating | MOTOR SPEED IN RPM | | | | | |
|---|---|---|---|---|---|---|
| | 3600 | | 1800 | | 1200 | |
| | Kvar† | % AR†† | Kvar | % AR | Kvar | % AR |
| 10 | 2.5 | 9 | 4 | 11 | 4 | 12 |
| 15 | 2.5 | 9 | 5 | 11 | 5 | 11 |
| 20 | 5 | 9 | 5 | 10 | 5 | 11 |
| 25 | 5 | 9 | 7.5 | 10 | 7.5 | 10 |
| 30 | 7.5 | 9 | 10 | 9 | 10 | 10 |
| 40 | 10 | 9 | 10 | 9 | 10 | 10 |
| 50 | 12.5 | 9 | 12.5 | 9 | 12.5 | 9 |

Data for Three-phase 60-cycle Open Induction Motors of 220-, 440-, 550-, and 2300-volt Rating.

† Kvar is rated kilovolt-amperes of capacitors connected at motor terminals.

†† Per cent AR is per cent reduction in line current due to capacitors.

Additional capacitor application data may be obtained by writing for Bulletin GEA-3225A. For product data on Pyranol capacitors to improve power factor, ask for Bulletin GEA-2742C. *Apparatus Dept., General Electric Co., Schenectady 5, N.Y.*

GENERAL ELECTRIC

407-100-2948

# EXPANSION JOINT MAINTENANCE

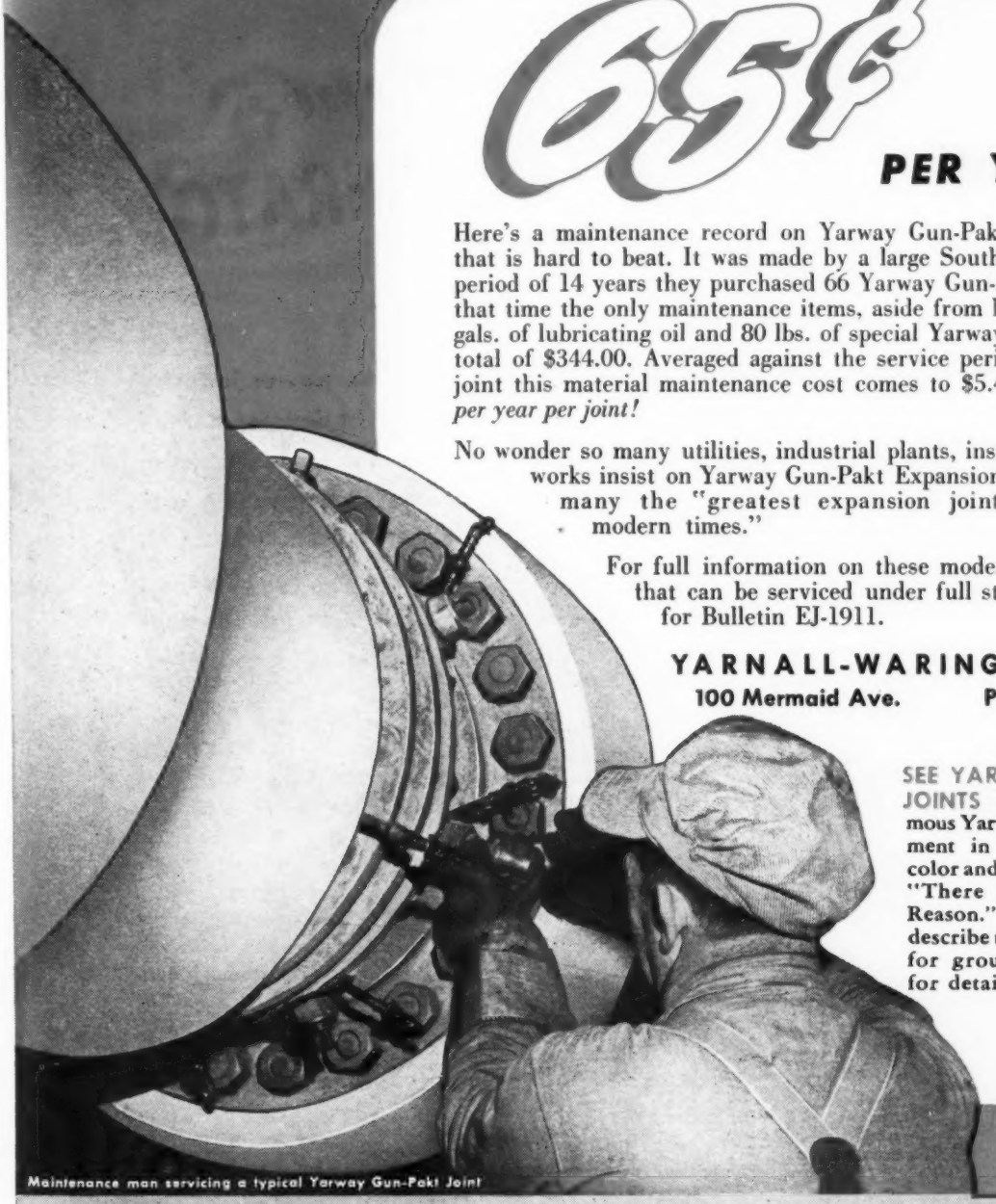
## 65¢ PER YEAR!

Here's a maintenance record on Yarway Gun-Pakt Expansion Joints that is hard to beat. It was made by a large Southern utility. Over a period of 14 years they purchased 66 Yarway Gun-Pakt Joints. During that time the only maintenance items, aside from labor, have been 42 gals. of lubricating oil and 80 lbs. of special Yarway packing, costing a total of $344.00. Averaged against the service period of each Yarway joint this material maintenance cost comes to $5.40—*or just 65 cents per year per joint!*

No wonder so many utilities, industrial plants, institutions and public works insist on Yarway Gun-Pakt Expansion Joints — called by many the "greatest expansion joint improvement of modern times."

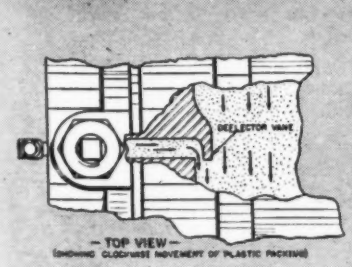
For full information on these modern expansion joints that can be serviced under full steam pressure, write for Bulletin EJ-1911.

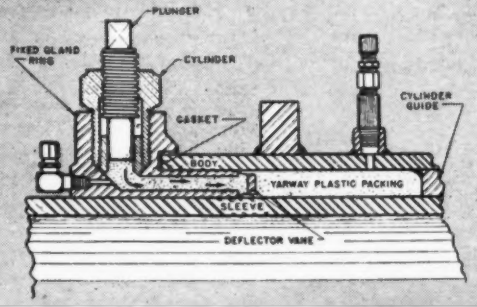
**YARNALL-WARING COMPANY**
**100 Mermaid Ave. Philadelphia 18, Pa.**

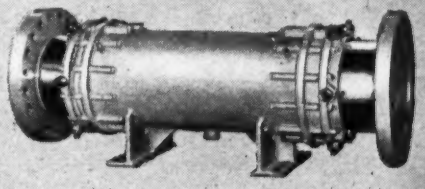


Maintenance man servicing a typical Yarway Gun-Pakt Joint

**SEE YARWAY EXPANSION JOINTS** along with other famous Yarway steam plant equipment in the new 30-minute color and sound motion picture "There Is An Engineering Reason." Hear Lowell Thomas describe their application. Free for group showings. Write for details.



Double end flanged-type Yarway All-Steel Gun-Pakt Joint, 300 lbs. pressure.

**YARWAY GUN-PAKT EXPANSION JOINT**

# *investment in experience...*

## *Components of the* MODERN STEAM GENERATOR

**milestones . . . In forty-seven years' service to the power industry solving problems of steam generation, Foster Wheeler has brought development of pulverized fuel systems and the three heat-absorbing surfaces of the modern steam generator to a high degree of operating efficiency . . . Continuous research and pioneering engineering have created a background of technical *know-how* upon which all new developments have drawn, and to which each new development has contributed . . . Net result of this backlog of experience has been the constant improvement in the design of high-pressure, high-temperature steam generators.**

**PULVERIZERS**—The first pulverizers to gain commercial acceptance were developed in 1898. Since then the basic design has undergone progressive improvement so that today low-grade anthracite may be successfully used as fuel. Development reached a peak in the record-setting availability mark of 99% established by Foster Wheeler ball mills using coal of 50—55 grindability.

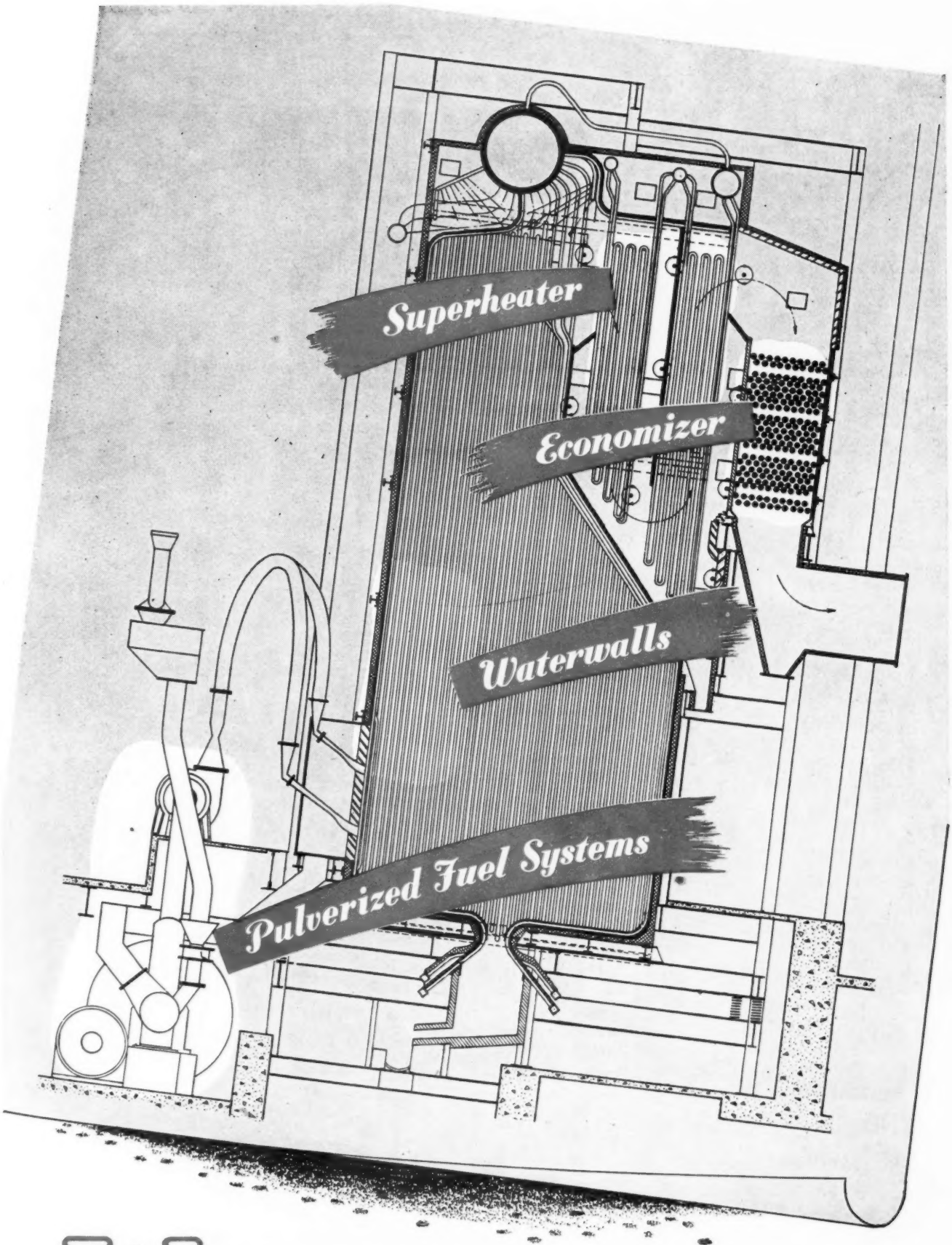
**SUPERHEATERS**—The first of the three essential components of the modern central station steam generator was introduced in 1904. Superheated steam, once accepted, brought new problems of high-temperature, high-pressure operation. As higher temperatures became common, the special problem of obtaining a constant final temperature over wide load ranges arose. Ultimately a combination type superheater was evolved from the radiant and convection types in use. The combination type insures constant final temperature over wide fluctuations of load.

**ECONOMIZERS**—Before 1919 the use of economizers for heating feedwater at full boiler pressure was practically unknown. When heat from stack gases was adapted to this purpose an overall gain in efficiency and a reduction in operating costs resulted. With the introduction in 1919 of the unit economizer, the second of the three essentials was established as standard equipment for steam generators.

**WATERWALLS**—Replacement of furnace brick walls with extensive water-cooled radiant heat-absorbing surfaces—*waterwalls*—was introduced in 1922. Although departing from established practice, the reasons for eliminating brickwork were proved sound by reduced maintenance costs, prolonged furnace life, and higher firing rates in a cooler furnace. This development—the third of the three essentials—paved the way for further progress in designs for operation at still higher temperature and pressure.

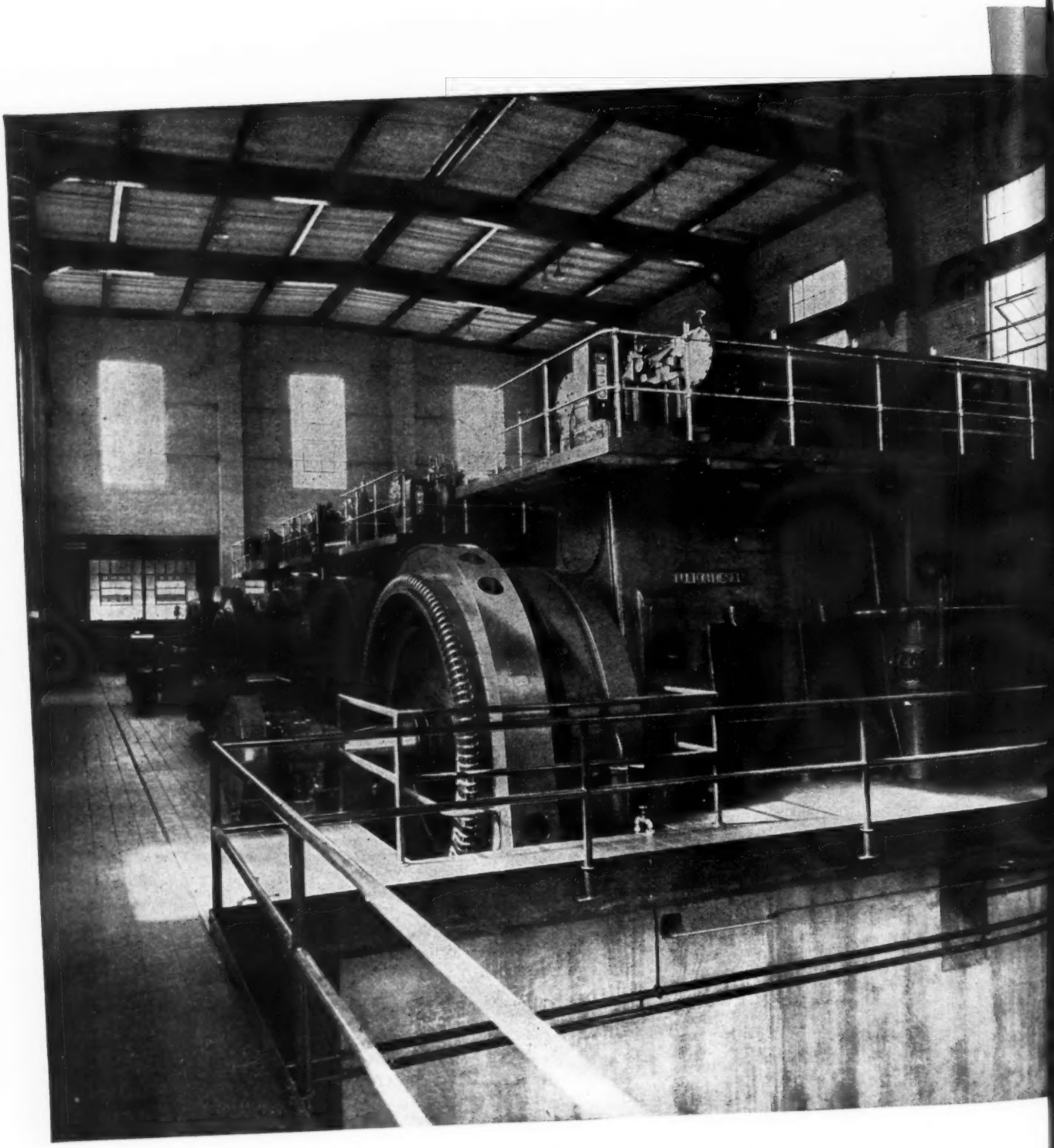
**FOSTER WHEELER CORPORATION**
**165 Broadway, New York 6, N. Y.**

FW FOSTER


Superheater
Economizer
Waterwalls
Pulverized Fuel Systems

# WHEELER

FW



TEXACO

TEXACO

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS

# More Power Output per Dollar Input

FAMOUS *Texaco Ursa Oils* keep Diesel engines clean, rings free, valves active. They greatly reduce wear and prolong the life of bearings, liners, rings and pistons. Consequently, you get greater power output, spend less for fuel and maintenance.

The Texas Company, in step with improvements in Diesel engine design over the past thirty years, has developed a complete line of *Texaco Ursa Oils*—one to assure effective lubrication of every type and size of Diesel.

Because of the benefits they deliver, *Texaco Ursa Oils* are approved by all leading Diesel engine manufacturers, and—

*More stationary Diesel hp. in the U.S. is lubricated with Texaco than with any other brand.*

For Texaco Products and Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

**URSA OILS**

**FOR ALL DIESEL ENGINES**

METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

# How to get more WORK out of

Now is the time when it will pay you to check up on the production efficiency of your processing equipment. Increasing operating speed and reducing heating time will help you meet the rise in manufacturing costs.

Armstrong Steam Traps are helping manufacturers get more work out of their power plant equipment because:

1. They remove condensate as fast as it is formed.

2. They discharge air and other incondensible gases along with the condensate.

3. They give continuous service, even when water conditions are bad, because dirt and sludge are discharged with the condensate and the all-stainless steel mechanisms are highly resistant to corrosion.

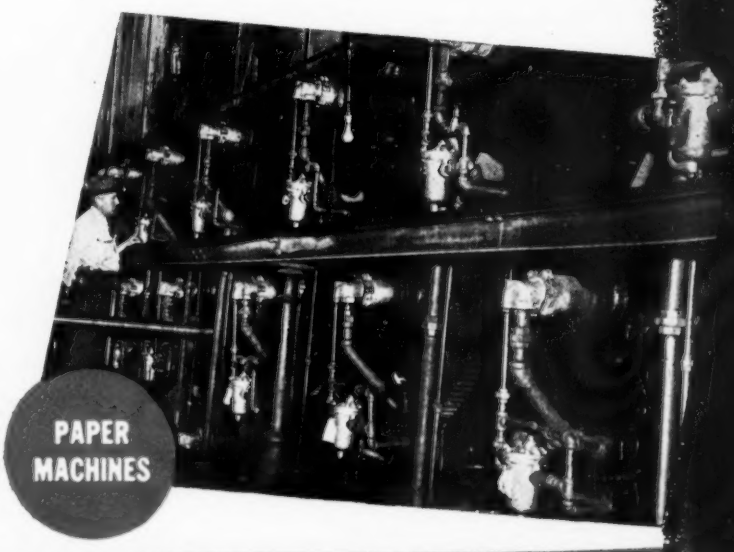
Write for a copy of Armstrong's 36 page Steam Trap Book, and the name of your Armstrong Representative.

**ARMSTRONG MACHINE WORKS**
**812 Maple St., Three Rivers, Michigan, U.S.A.**

## TRAPPING TIPS*

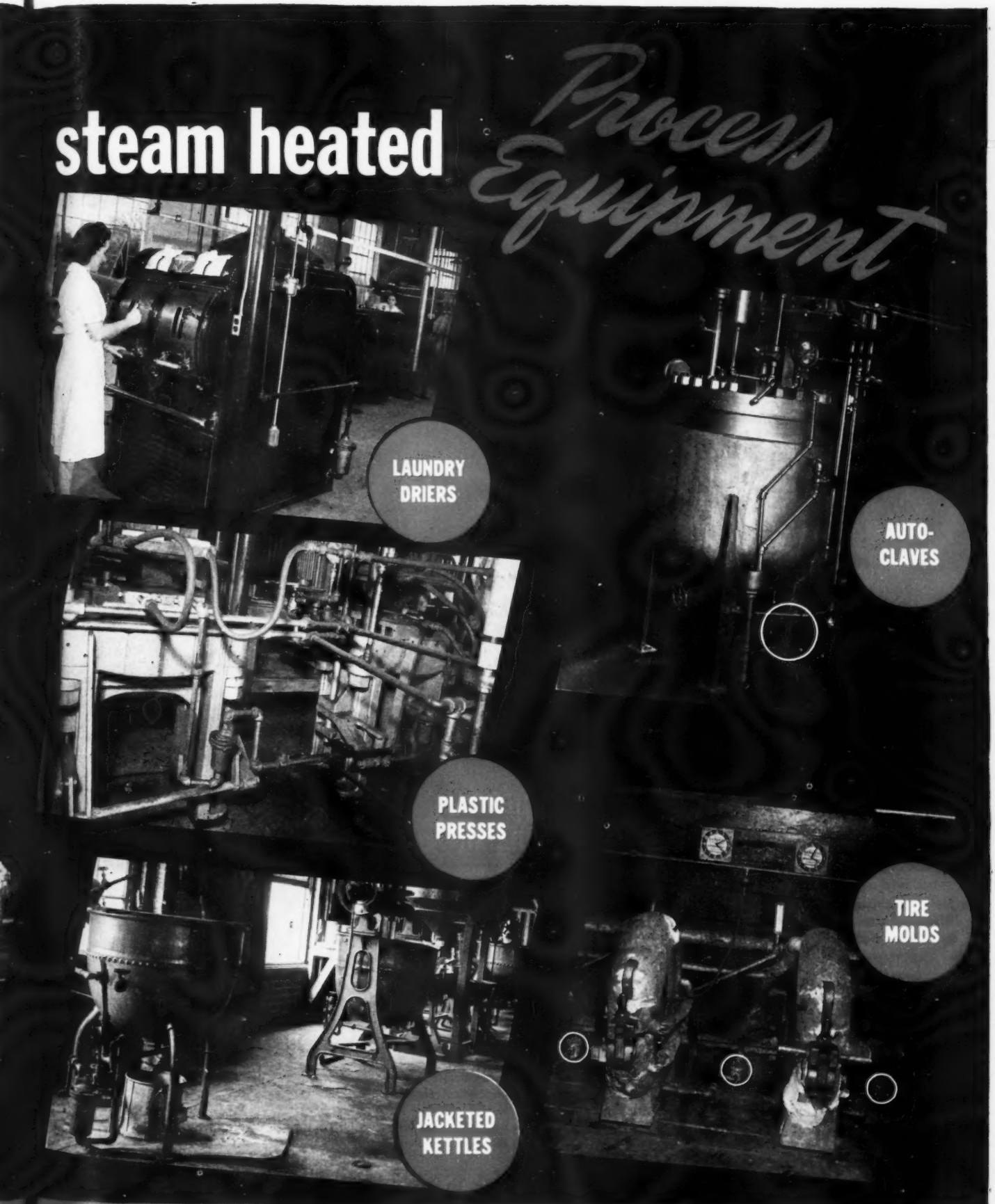
1. Use a trap on each unit.
2. Wherever possible, install the trap close to and below the unit being drained.
3. Use traps that automatically discharge air as well as condensate. Where extra air handling capacity is required, check with your Armstrong Representative.
4. Avoid using traps that require the condensate to cool before it can be discharged.
5. Avoid using undersize traps. Allow an adequate safety factor to handle peak loads.

*The ARMSTRONG STEAM TRAP BOOK contains complete data on trap selection, including calculation of condensation and heat transfer rates plus recommended safety factors. Ask for a copy.




**ARMSTRONG**
*Over a Million in Use!*

# steam heated *Process Equipment*




*Inverted Bucket* **STEAM TRAPS**

*For Power . . . Process . . . Heating*

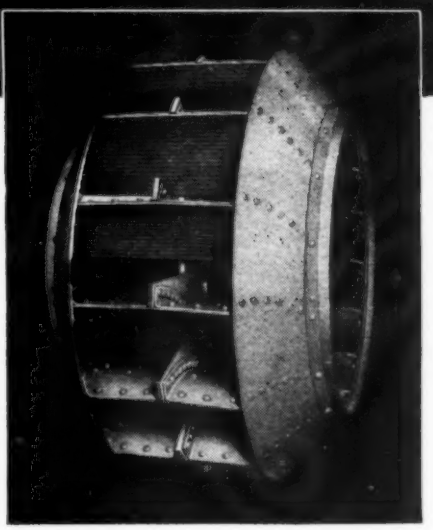
## Design #3 gives you HIGHER EFFICIENCY than you thought possible in an I.D. fan

Here, for the first time, is an induced draft fan that delivers the same high efficiency that was once considered possible only in forced draft systems!

Known as the T.V.I.D. Design #3, this latest achievement in induced draft engineering is the result of years of pains-taking research—much of it under conditions of war-time secrecy, when Sturtevant was working hand-in-glove with the Navy to develop new and better fans for our fighting ships. Not only is the Design #3 more efficient—it also has the capacity to handle higher volumes and pressures. Housing is of reinforced heavy steel plate, split on center lines to facilitate wheel removal. Blade tips are designed to provide easy exit for concentrated fly ash, making the fan self cleaning. What's more, you can count on—

### 2 to 4 times longer life with Sturtevant E. R. wheel!

Fly ash that eats into blades and centerplate limits the life of the ordinary induced draft fan wheel to a matter of months. But in many plants, the Sturtevant erosion-resisting wheel shows little sign of wear—and no loss of efficiency—after *years* of service! That's because this exclusive Sturtevant design makes fly ash *attack itself* —and not the wheel.



HEATING • VENTILATING • AIR CONDITIONING •

DRYING • DUST AND FUME CONTROL

# WHY THIS FAMOUS TRADE SLOGAN



# NOW HAS NEW IMPORTANCE

# FOR THE POWER INDUSTRY

## Sturtevant is now "Putting Air to Work" as a Division of Westinghouse Electric ...3 *new advantages!*

By pooling resources with Westinghouse Electric, Sturtevant now offers the most complete line of air handling systems ever available from a *single manufacturing source.* To the Power Industry this means three important new advantages:

1. **UNDIVIDED RESPONSIBILITY** in dealing with one source for all air handling equipment . . . from Sturtevant mechanical draft systems, to Westinghouse motors, controls, and the new Precipitron* . . . from planning to assembly, final installation and service.

2. **IMPARTIAL ENGINEERING HELP** because the two organizations together manufacture every component part of the complete system, and in such variety as to be able to recommend—and *assemble*—exactly the right equipment for any given job.

*Trademark registered in U.S.A.

3. **COST SAVINGS** that come from buying air handling and air cleaning equipment in one complete "package". No extras, no added costs.

The new Design #3 Induced Draft Fan (described on the opposite page) is Sturtevant's latest addition to a wide range of power apparatus that has given distinguished service in leading plants throughout the country. And now Westinghouse rounds out this famous line by the addition of motors, controls, and the electronic air cleaner, *Precipitron,* considered one of the most important air cleaning developments of recent years.

A Sturtevant engineer will gladly study your air handling problems, and show you what the Sturtevant-Westinghouse combination can mean to you in higher efficiency, space savings and lower cost. Inquiries should be addressed to: B. F. Sturtevant Company, Division of Westinghouse Electric, Hyde Park, Boston 36, Mass.

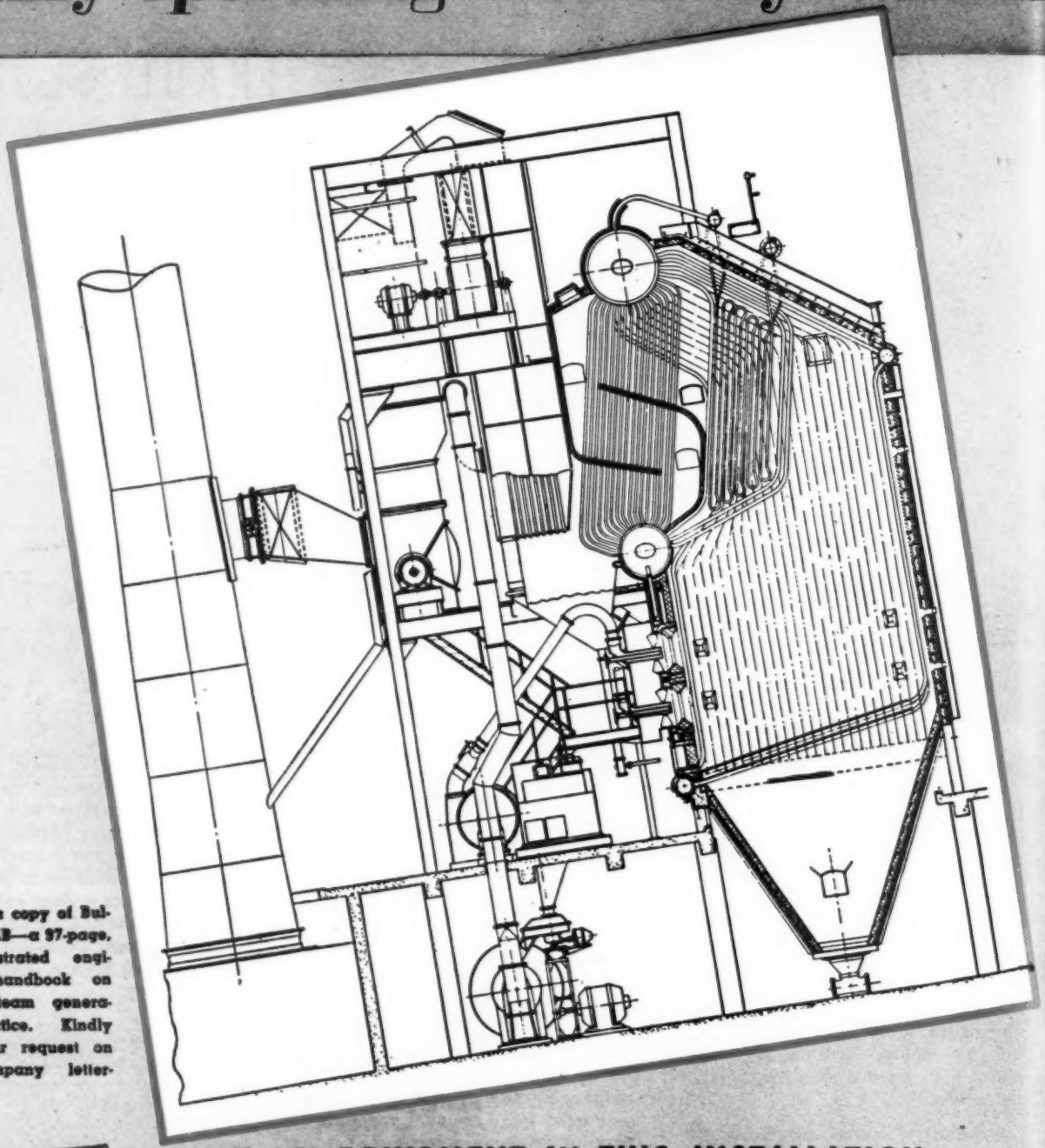
B. F. STURTEVANT COMPANY • DIVISION OF

Westinghouse ELECTRIC

PRECIPITRON

MECHANICAL DRAFT

# Daily operating efficiency—of this



Write for a copy of Bulletin No. 44B—a 97-page, fully illustrated engineering handbook on modern steam generation practice. Kindly make your request on your company letterhead.

## K.V.S. EQUIPMENT IN THIS INSTALLATION

STEAM GENERATOR
WATER AND SHADOW WALLS
SUPERHEATER
ECONOMIZER
AIR PREHEATER
AIR SWEPT TUBE MILL
HORIZONTAL MIXING TYPE BURNERS
STEAM PURIFIER

●

K. V. S. Engineering Service is available to assist you in meeting your steam generating requirements.

# KVS steam generating plant is...

# 88.% Plus

## FEATURES AND OPERATING DATA

*Plant Owner* — American Colloid Division, E. F. Drew Company, Boonton, New Jersey.

*Capacity Boiler* — 60,000# steam per hour.

*Operating Pressure*—500 psi.

*Steam Temperature*—750° F.

*Fuel* — Bituminous Coal — 13,250 B.T.U. per lb., 9% ash.

*Steam Purity*—0.5 parts per million.

*Operating Efficiency*—88% plus.

*Guaranteed Efficiency* — 87.3%. (The operating efficiency over and above guarantee is due largely to superfine pulverization).

*Firing*—Pulverized Coal (or oil).

(Further details of this boiler will be found on p. 53 of K.V.S. Bulletin No. 44B, available on request).

This entire plant was designed and erected under one responsibility—K.V.S. Engineering Service.

Kennedy Products

**Kennedy-Van Saun**

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES, DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

ARMY E NAVY

# YOU GET

*Just tilt the bezel flange and all zero adjustment knobs, connections, etc., are at your finger tips.*

# ALL OF THESE FEATURES

## In The Republic Multi-Point Draft and Pressure Gage

**1. EASY TO OPERATE:** All adjustments can be made from the front of the gage regardless of whether it be flush or projected mounted. On the flush mounted gage a bezel flange, which tilts back, conceals the zero adjusting knobs, pipe connections, mounting bolts, etc.

**2. INDIVIDUAL UNITS:** Each draft or pressure element is individually housed in a die cast case forming a complete compact unit.

**3. UNITS EASILY REMOVED:** The individual units can be removed from the front of the gage as you would remove a book from a shelf. This can be easily and quickly done without interfering with the operation of any other unit.

**4. EASY TO MAINTAIN:** Because each element is a complete unit in itself which can be easily removed, maintenance is greatly simplified.

**5. INDIVIDUAL ILLUMINATION:** Each scale is individually illuminated from the back by a light located outside of the element housing.

**6. UNIFORM SIZE:** All units are of one standard size which permits new units to be added or interchanged as required.

**7. ALL STANDARD RANGES:** Elements are supplied for all standard ranges of draft, pressure or differential.

**8. SENSITIVE DIAPHRAGM:** All elements, except those for high pressures, are actuated by an extremely sensitive bellows type of diaphragm.

**9. MULTIPLE UNITS:** Any number of units of draft, pressure or differential may be combined in one multi-point gage which is supplied for either flush or projected mounting.

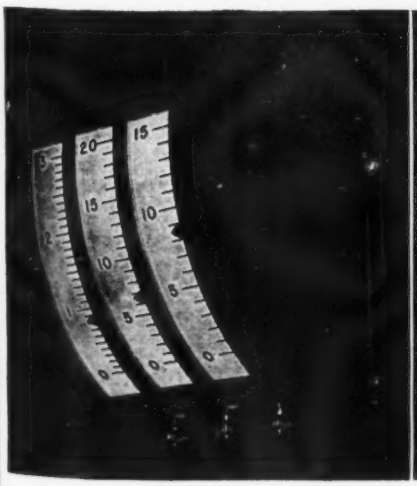
**10. FLOW, $CO_2$, TEMPERATURE:** Developed primarily to indicate drafts, pressures and differentials, the Republic multi-point gage can also be made to indicate other quantities such as flow, $CO_2$, temperature, liquid level, etc. In each case the corresponding standard Republic instrument is used.

The sectional view shown on the opposite page illustrates the extreme simplicity and compactness of the Republic Multi-Point Draft and Pressure Gage. Every detail has been designed to assure ease of maintenance and continuous operation as well as accuracy and sensitivity.

*Write for a copy of Bulletin No. 802*

# REPUBLIC FLOW METERS CO.

**2222 DIVERSEY PKWY. CHICAGO 47, ILLINOIS**



*Supplied for either flush or projected mounting.*

*Any unit can be easily removed from the front without disturbing any other unit.*

*Each element is a complete, compact, sealed unit.*

# MOTOR BURNOUTS

## *can be prevented by protecting MOTORS with FUSETRONS*

Fusetrons have a tremendous time-lag. Thus, on normal installations, they can be used in a size near to the actual running current of the motor without opening on motor starting current or other harmless overloads.

When so used, Fusetrons protect motors from ANY harmful excess of current—caused by such things as being stalled, lack of oil, worn bearings, tight belt, overloading, wrong voltage or SINGLE PHASING.

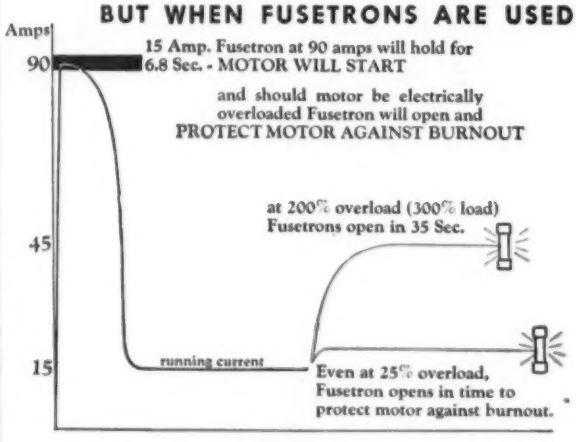
## Ordinary Circuit Protective Devices Cannot Protect Motors Against Burnout

Such devices do not have sufficient time-lag, when used in motor-running protection size, to hold the motor-starting current. For example:

The starting current of a 15 amp. A. C. motor is 90 amps. or more, enough to blow an ordinary 15 amp. fuse in about 1/10 second, or a 15 amp. ordinary breaker in about 2½ seconds. In either case, the circuit would be shut down before the motor could get up to speed.

To permit a motor to start a 35 amp. breaker or a 45 amp. fuse would commonly be used. Then an excess current of from 133% to 200% of the motor rating could cause the motor to burn out—without opening the protective device.

**BUT WHEN FUSETRONS ARE USED**


Amps
90
45
15
15 Amp. Fusetron at 90 amps will hold for 6.8 Sec. - MOTOR WILL START
and should motor be electrically overloaded Fusetron will open and PROTECT MOTOR AGAINST BURNOUT
at 200% overload (300% load) Fusetrons open in 35 Sec.
running current
Even at 25% overload, Fusetron opens in time to protect motor against burnout.

Thus any motor from 1/10 to 500 amp. size can, on normal installations, be protected by Fusetrons if used in motor-running protection size.

**Fusetrons Give DOUBLE Protection to Large Motors.** Of course, larger motors are protected with thermal cutouts or overload relays. They save many motors—but experience shows that such devices sometimes fail to operate and a motor burns out.

By replacing fuses used for short-circuit protection with Fusetrons of MOTOR-RUNNING protection size, you get the same short-circuit protection PLUS DOUBLE PROTECTION against motor burnout from single phasing or any other cause.

**Fusetrons will act INDEPENDENTLY to SAVE THE MOTOR.** There is nothing to stick, nothing to go wrong. They cannot be reset nor can corrosion or dirt lengthen their blowing time. When the solder in the thermal cutout melts the circuit is open—there is no way it can be held in or jammed.

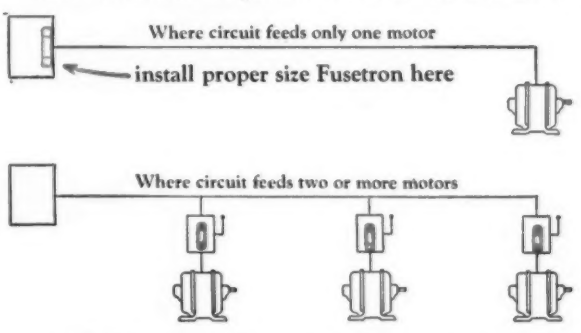
**Fusetrons provide simplest way to prevent damage from Single Phasing.** When single phasing occurs the current flowing through motor and through Fusetrons in the remaining phase increased about 100%. (Theoretically 73% but change in efficiency and power factor makes it about 100%).

This 100% overload on Fusetrons of MOTOR-RUNNING protection size opens them and STOPS FLOW OF CURRENT to the motor.

Never before has such dependable single phasing protection been available to prevent motor burnouts.

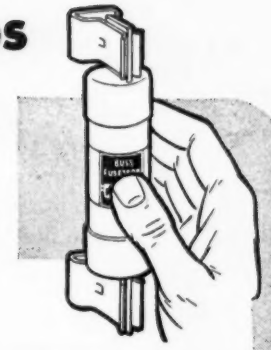
**Fusetrons make protection of SMALL Motors against burnout, simple and inexpensive.** Heretofore, SMALL motors have often been left unprotected because the cost of protection has been too great compared to the cost of replacing the motor. Yet a burnout means replacing the motor—PLUS the loss of labor and production.

Now look how simple it is to avoid such losses . . .




Install Fusetron in switch or fuse block to protect each individual motor . . . or on portable tools or devices, install Fusetron in attachment plug or connector or in a fuse block attached to device.

# A Fusetron turns any set of fuse clips into a Motor Protective Device . . .



. . . as accurate, as safe and as dependable as any device on the market; regardless of cost. Fusetrons have the same degree of approval for both motor-running protection, under National Electrical Code and Underwriters' Laboratories Standards, as do the most expensive devices made.

## WHAT IS THE FUSETRON?

The Fusetron is a DUAL element device—A Fuse to which is added a Thermal Cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratories' approval for both motor-running and circuit-protection as the most expensive devices made.

*Fit standard fuse blocks*

Fusetrons are made to same dimensions as ordinary fuses and fit all standard fuse holders.

They are obtainable in all sizes from 1/10 to 600 ampere—in both 250 and 600 volt types.

Also obtainable in plug type and Tamper-resisting type (Fustats) for 125 volt circuits.

**Their Cost Is Surprisingly Low**

## Says a Nationally Known Consulting Engineer

"We recommend Fusetrons to all our clients because we have found them superior to any other device to protect motors against burnout.

"Here's an illustration of our experience with Fusetrons.

"One of our filling station clients reported by telephone that his compressor was not operating. Our Mr. Hrastich called and found that Fusetrons in the circuit had blown. With new Fusetrons installed, the compressor operated for 3 minutes, then slowed down and the Fusetrons blew. Inspection showed that the bearings of the motor were dry. When the bearings were oiled, the motor operated without any difficulty.

"The client could see for himself that the Fusetrons had saved him a burned-out motor, a major shutdown and a repair bill."

H. J. Brandenburger
Carleton B. Fox Company,
St. Louis, Missouri.

## INSTALLED THROUGHOUT THE ENTIRE ELECTRICAL SYSTEM, FUSETRONS GIVE MANY KINDS OF PROTECTION HERETOFORE NOT AVAILABLE

*Fusetrons do everything fuses do. They open on harmful overloads and on short-circuits stop the flow of current quickly and safely, all of which is confirmed by the Underwriters' Laboratories Label . . . and in addition you can*

★ ***Entirely wipe out needless blows caused by motor starting currents or other harmless overloads.***

Fusetrons have tremendous time-lag. They hold 500% load more than 10 seconds whereas most sizes of ordinary fuses blow in less than one second. They won't open on starting currents or harmless overloads (heavy overloads for a short time or light overloads for a longer time). Fusetrons won't shut down a circuit needlessly. They open only when something goes wrong.

★ ***Give Thermal Protection to Panelboards and Switches***

The thermal cutout in the Fusetron will open whenever its temperature reaches 280° F. Thus if poor contact heat develops from any cause the Fusetron cuts off the current before damaging temperatures can be reached.

Ordinary fuses can't so protect because the temperature of the link must reach 786° F. before it will melt out.

With Fusetrons you are warned that a minor maintenance job is needed instead of having panel or switch damaged or destroyed by poor contact.

★ ***Prevent Needless Blows caused by Heating in Panels and Switches***

Fuses have 55 to 140% greater electrical resistance at full load than Fusetrons, hence Fusetrons produce less heat than any fuses. They operate cooler and eliminate useless shutdown troubles caused by fuses running too hot.

★ ***Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel***

The operating load on Fusetrons can be close to their ampere rating because Fusetrons hold starting currents. But ordinary fuses must be installed oversize because they lack sufficient time-lag to hold starting currents

By replacing oversize fuses with Fusetrons, you can load panels or switches near their capacity. A larger motor or additional motors can be installed without the trouble or expense of changing the panel or switch.

★ ***On new installations, PROPER size switches and panels can be used instead of OVERSIZE***

With ordinary fuses, switches and panels must be oversize because fuses larger than the operating load must be used to hold starting currents.

But Fusetrons hold starting currents, therefore, PROPER size switches and panels to fit the load can be installed, saving money and space.

★ ***Protect motors against burnout*** (See opposite page)

★ ***Protect Coils, Transformers and Solenoids against burnout***

Install a proper size Fusetron. It won't open on harmless overloads of normal current surges, yet should a dangerous overload occur for any reason it will cut off the current to prevent a burnout.

## BEFORE YOU MAKE ANY CHANGES OR START ANY NEW WORK

### GET ALL THE FACTS—CHECK THE COSTS
### USE THE COUPON

Even one lost motor or one needless shutdown or one destroyed panel, may cost you more than replacing every fuse with a Fusetron. Don't risk such losses, change over the whole plant to Fusetrons at once.

346

BUSSMANN MFG. CO., University at Jefferson, St. Louis 7, Mo. (*Division McGraw Electric Co.*)
Please send me complete facts about BUSS Fusetrons.

Name_____
Title_____
Company_____
Address_____ State_____ P 346
City_____

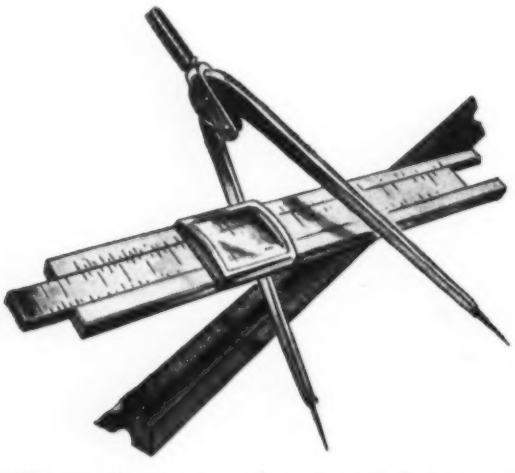
# BUSS FUSETRONS

# Ever Figure What a 765 hp Motor Throws Off in Heat?

**Our Navy Did...** on fleet tugs down in the tropics, where engine room temperatures were running high as 140°F! In 25 by 30 ft of space, that's like having 140, thousand-watt radiant heaters "raising blisters" on you all at one time!

**Here's How Navy Figured:** To get 765 shaft hp out of 94% efficient propulsion motors, of which there are four aboard, they were putting in about 812 hp of electrical energy. Or, 47 hp went in that didn't come out of the shaft, but escaped through the frame. This ran about 35 kw heat per motor.

**Well, Our Temperatures Began To Rise** when Navy laid down its 'specs'. "Design a marine water-cooled motor—make it fit into the floor space of your open drip-proof type—no major changes in ship design. Make it extra-dependable, as fireproof as practicable".



**We Measured,** and figured, and made designs—used a new, toxic gas-free Glass Melamine insulation that required extensive changes in design and fabrication. We put special air passages inside the motor—yet kept accessibility. We saved 25% space over our previous commercial marine design by figuring a special shape cooler—without cutting down cooler efficiency.

**Then We Made Those Motors Shock-Proof** — by cutting out all cast iron, re-designing structural members for greater strength, resorting to modern, proven fabrication throughout. Result: A new kind of water-cooled motor that put a "tough" Navy job on ice, and also proved a point! A 1999

**There's a Point** to this story: Every time Allis-Chalmers engineering discovers new ways of solving *special* motor problems, like this one, it also learns how to build better *standard* motors for you! Watch for these new and better motors from A-C. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

**Wait 'til you see the NEW**

**ALLIS-CHALMERS MOTORS!**

**HEAR THE BOSTON SYMPHONY:** *Every Saturday Evening, American Broadcasting Co.*

Announcing

# NI·ROD

## . . . a new, easy-handling electrode that gives you STRONG, SOUND, MACHINABLE welds in cast iron

With the new Ni-Rod welding electrode you can repair broken or worn castings . . . remedy casting defects right in your own plant . . . or do any welding job on cast iron where strong, sound, machinable welds are essential.

*. . . and you'll have an easy time!*

For Ni-Rod has such outstanding flow characteristics that slight variations in manipulation of the electrode have little effect on weld quality.

Already proved by extensive tests in the field, Ni-Rod offers these welding advantages:

**Superior arcing characteristics**
**Fine wash**
**Excellent bead contour**
**Easily removable slag**
**Preheating not generally required**
**Can be used on A.C. or D.C.**

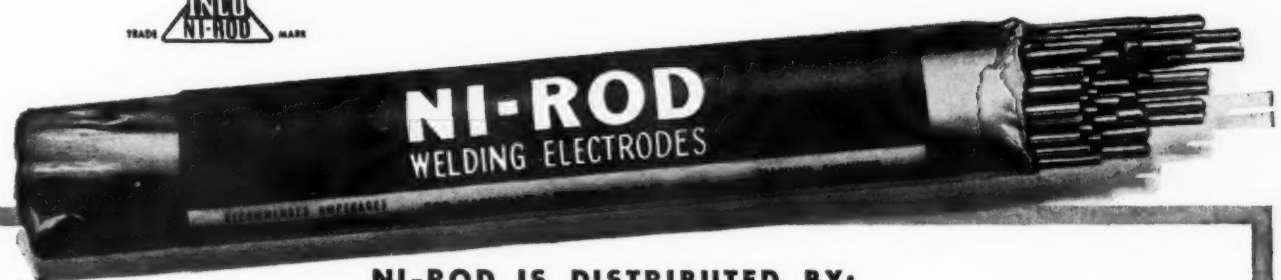
**SEND FOR NI-ROD BOOKLET**

Ni-Rod deposits are smooth, even, and close to the color of cast iron.

Make up your mind now to order a trial 5-lb. package . . . so you can see for yourself why welders are calling Ni-Rod, *"the easiest-handling electrode for welding cast iron."*

**THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.**

INCO NI-ROD TRADE MARK




### NI-ROD IS DISTRIBUTED BY:

**WHITEHEAD METAL PRODUCTS COMPANY, INC.**, Baltimore—Boston—Buffalo—Newark—New York—Philadelphia—Syracuse

**WILLIAMS and COMPANY, INC.**, Cincinnati—Cleveland—Columbus—Pittsburgh

**STEEL SALES CORPORATION**, Chicago—Detroit—Milwaukee—Minneapolis

**PACIFIC METALS COMPANY, LTD.**, Los Angeles—San Francisco

**J. M. TULL METAL & SUPPLY CO.**, Atlanta

**METAL GOODS CORPORATION**, Dallas—Houston—New Orleans—Tulsa

**EAGLE METALS COMPANY**, Portland—Seattle

**HENDRIE & BOLTHOFF MFG. & SUPPLY CO.**, Denver

**ROBERT W. BARTRAM**, Montreal

**ALLOY METAL SALES, LTD.**, Toronto

**WILKINSON COMPANY, LTD.**, Vancouver

*Call or write for more information.*

# Scovill Tube News

Vol. 4 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 1


# Laboratory Services Trace Conditions Affecting Condenser Tubes

An important part of Scovill's service to users of condenser and heat exchanger tubes is the facilities of its laboratory, available to you for the tracking down of conditions causing tube failures.

Experienced personnel, operating modern equipment, perform tests and determinations necessary to arrive at the chemical, metallurgical and physical facts concerning the tubes which will eliminate guesswork in studying application problems.

Pictures on these pages offer a tabloid account of what our laboratory is prepared to do for you. They illustrate services which are rendered in addition to the standard specification tests made on individual orders.

*Analyses of Elements* — Unidentified samples of compounds, corrosion products, deposits or

alloys — sometimes as small as the head of a pin — are analyzed spectrographically to determine the elements present. After classification, a sample might be partially or completely analyzed in this *Spectrographic Department* or turned over to the Chemical Department for complete analysis of the elements as identified. Special spectrographic technique not only can trace concentrations of elements as low as 0.001 per cent, but also assures identification of all determinable elements present in unknown samples.

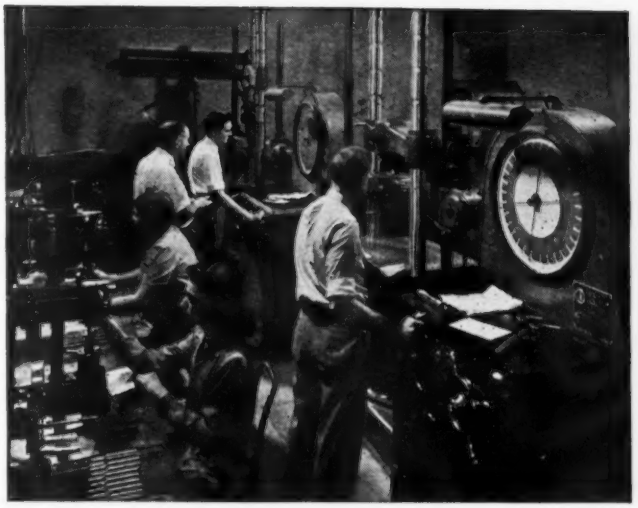
*Performance Predictions* — Spectrographic results plus the results of analyses made in our *Chemical Department* can reveal conditions

likely to cause early tube failures. The chemists in this department analyze ferrous and non-ferrous alloys, corrosion products, deposits, compounds, circulating waters, condensates, paints, and oils to help establish the facts and details associated with a tube application problem.

*Metallurgical Structure* — Metallographic examination of a tube at from 50 to 1000 times magnification reveals subsurface defects, possible unsoundness, inclusions, and improper grain structure. Such an examination, made in our ***Metallurgical Department,*** also reveals the nature of the metallurgical structure. This knowledge is important, for a tube material that is chemically

as specified may have metallurgical defects that cause early failure. Microscopic study of tube surfaces also reveals certain tube corrosion characteristics not visible to the unaided eye. Also, the characteristics of cracks as viewed microscopically indicate their probable causes.

*Testing for Faults* — An important part of the metallurgical data, necessary in establishing the facts to work with in studying a tube problem, is the physical and mechanical testing of the



material as performed in our ***Physical Department.*** This information, coupled with metallurgical examination, quickly tests the quality of the tubes in question. Subsurface defects and hairline cracks are readily made visible by methods established in this department.

## Three Scovill Services

The laboratories shown here constitute a part of our ***Service in Metals*** which also includes the production of many tube alloys, and the selection of the proper alloy for specific operating conditions. ***Service in Men*** provides specialized consultation on individual tube application problems and suggestions regarding installation practices. ***Service in Manuals*** covers literature prepared from the wide experience of our engineers and laboratories to give you the latest, most authentic information on condenser and heat exchanger tubes; for a free copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn.


SCOVILL

***This is Number Seventeen in a series of Scovill advertisements to help you get longer life from condenser and heat exchanger tubes.***

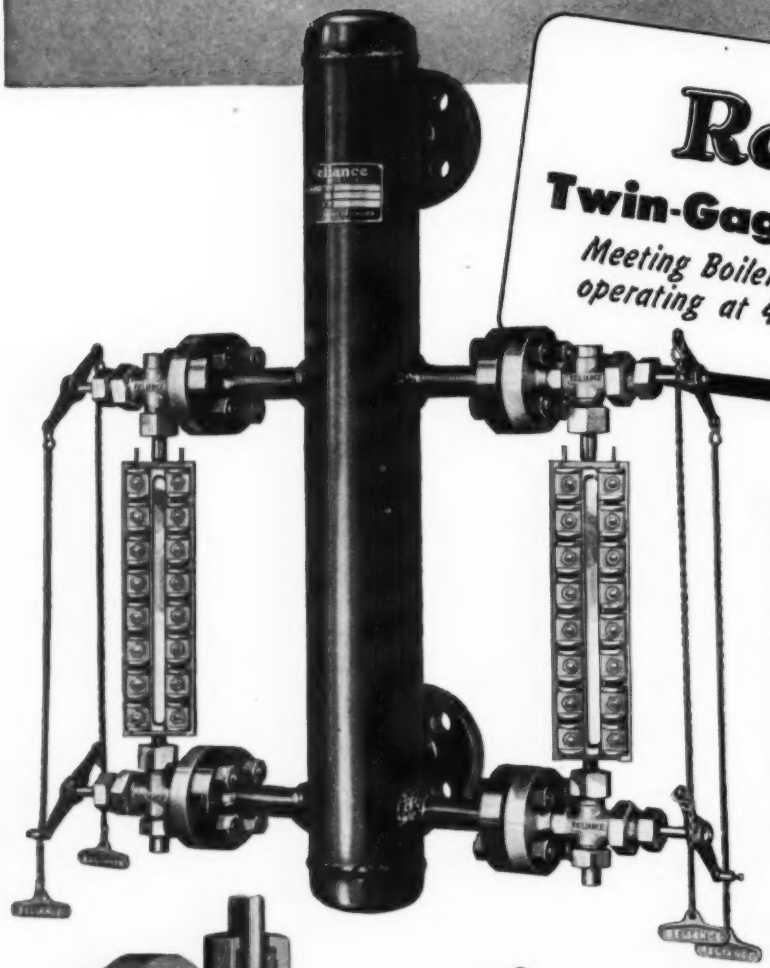
**SCOVILL CONDENSER TUBES**

*ONE PRODUCT... THREE SERVICES*

**Service in Manuals... Service in Metals... Service in Men**

# Here's your simplest and most convenient method of mounting two boiler water gages at the same elevation . . .

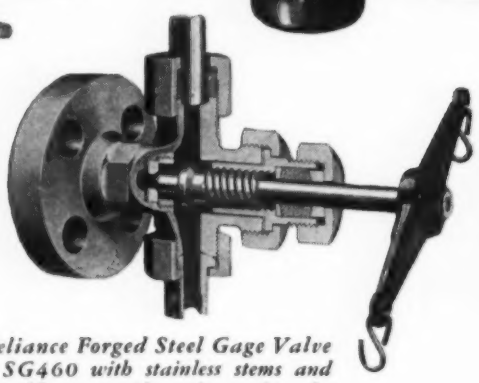
## Reliance
### Twin-Gage Water Columns
*Meeting Boiler Code Requirements on units operating at 400 pound W.S.P. or above*



GOOD PRACTICE in applying the code requirements for two water gages on high pressure boilers dictates a *water column assembly* for flexibility of placement, ease of providing mechanical support, greater stability of water level indication, provision for high and low alarm signal if desired, and over-all convenience and safety of operation. One approved method is to employ two conventional water columns—on opposite drum ends—each having a single water gage. Another method is the use of twin gages on a single column, with flanges (or welding necks) at 180° separation, as in the illustration, or at various angles, bringing flanges as close as 90°.

Reliance all-welded Water Columns with twin gages have been available since this requirement went into effect. Several installations of many months service have proved completely satisfactory in continuous operation. You can get complete Reliance Water Column and Gage equipment for your high pressure boilers, in standard or custom-made models.

Write Reliance for complete information, or check with your consulting engineer.



● *Reliance Forged Steel Gage Valve No. SG460 with stainless stems and renewable seats. Also other valves for pressures to 2000 lbs.*

● *Reliance Mica-Protected Flat Glass Water Gage Insert — an efficient, shatterproof indicator built for clear readability and safety on high pressures.*

BOILER SAFETY DEVICES since 1884

## Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

# *ANNOUNCING* A New Line of Dry-Type Transformers!

**14 SIZES** Ranging from 1½ to 300 KV — Single and 3-phase

☛ First mass-produced during the war for U. S. fighting ships, these new Allis-Chalmers Class "B" Insulated Dry-Type Transformers overcame critical weight and space limitations.

☛ Today, incorporating these same war-proved advantages, they're being produced for industries, utilities — to bring you simpler, safer and cheaper power distribution — new, long transformer life . . . at no advance in price!

☛ For complete details, get in touch with your nearby A-C dealer or district office — or send today for new descriptive bulletin B6382. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

A-C

**HEAR THE BOSTON SYMPHONY:** *Saturday, American Broadcasting Co.*

## NO OTHER DRY-TYPE TRANSFORMER GIVES YOU ALL THESE 6 MONEY-SAVING ADVANTAGES...

**1 Up to ⅓ Lighter!**
These new 80° C rise class "B" insulated transformers weigh 22% to 38% less than the old 55° C rise units, take fewer, lighter mountings.

**2 Up to ⅓ Smaller!**
The new design of these transformers also results in smaller overall size. That means easier handling for workers, quicker, cheaper installation.

**3 Wider Application!**
Not only lighter, more compact, but quieter, better-looking! They go in almost anywhere . . . on posts, walls, overhead platforms—even on machines.

**4 Greater Safety!**
No liquid to test, filter or change; nothing to promote combustion. Result: no fireproof vaults needed — you get safer installation inside buildings.

**5 Longer Life!**
New class "B" insulation used in these transformers affords greater protection against moisture — won't deteriorate with age — won't stretch or shrink!

**6 Same Low Prices!**
Yes, you can buy the new, improved class "B" insulated dry-type transformers for the same prices as ordinary class "A" insulated units.

**ALLIS-CHALMERS, MILWAUKEE**

ALLIS-CHALMERS MFG. CO.
Milwaukee 1, Wis.

Gentlemen:

Please send me your Bulletin B6382 describing the new line of Dry-Type Transformers.

(Name) _____

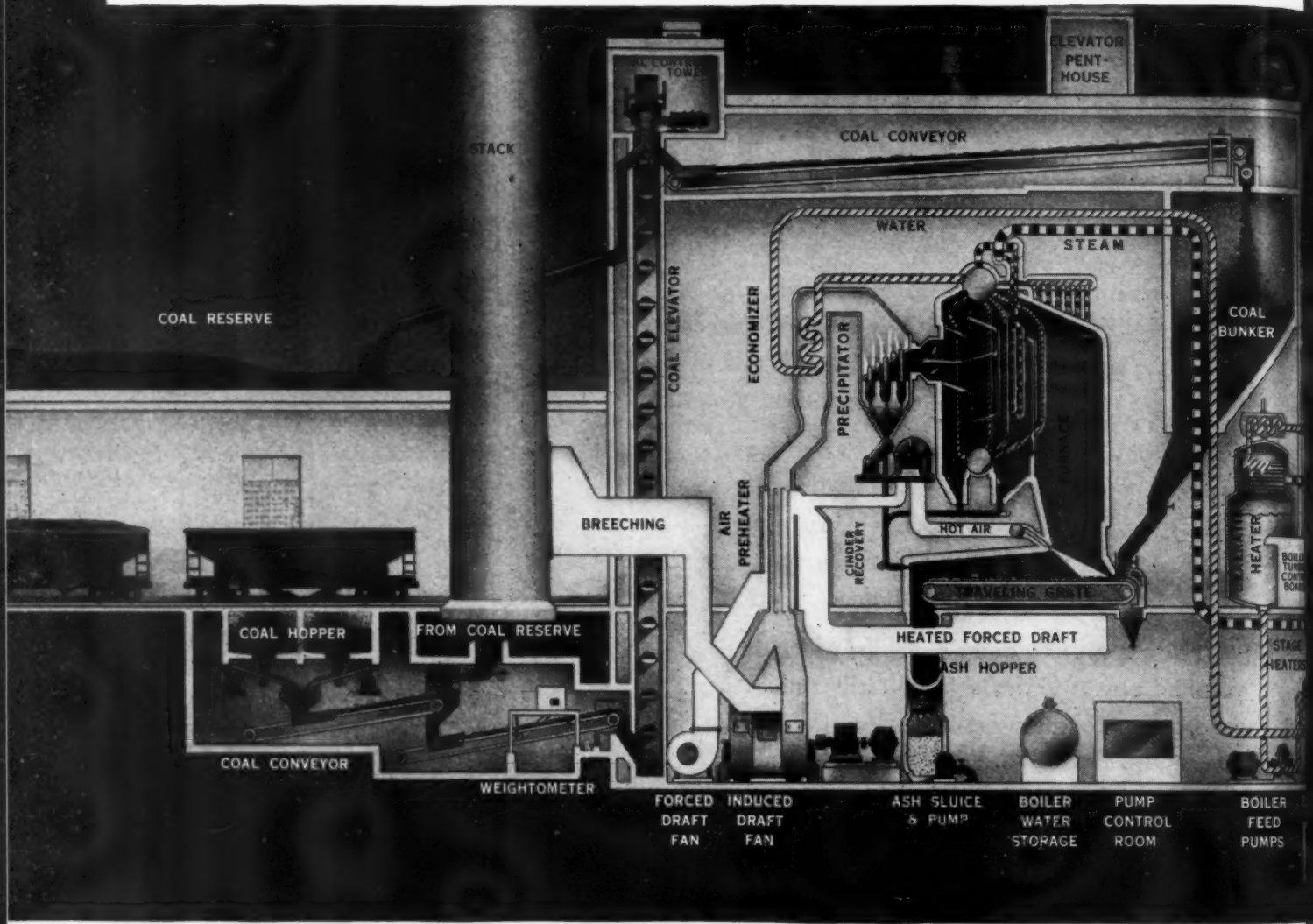
(Title) _____

(Company) _____

(Street Address) _____

(City and State) _____ A 1986-5

# JENNISON STATION




C-E Traveling Grate Stokers, the largest of their type in utility service, fire two 200,000-lb capacity C-E Boilers.

On December 13, 1945, the Jennison Station of the New York State Electric & Gas Corporation, Bainbridge, N. Y. – first new power generating station to be placed in service since the end of the war – was officially opened. No ordinary "opening" this, for all elements of the community and surrounding rural areas were well represented in the inspection parties which toured the plant following the dedication ceremonies and on succeeding days. As a result, the people of this region have received a very favorable impression of the new generating facilities built to serve them.

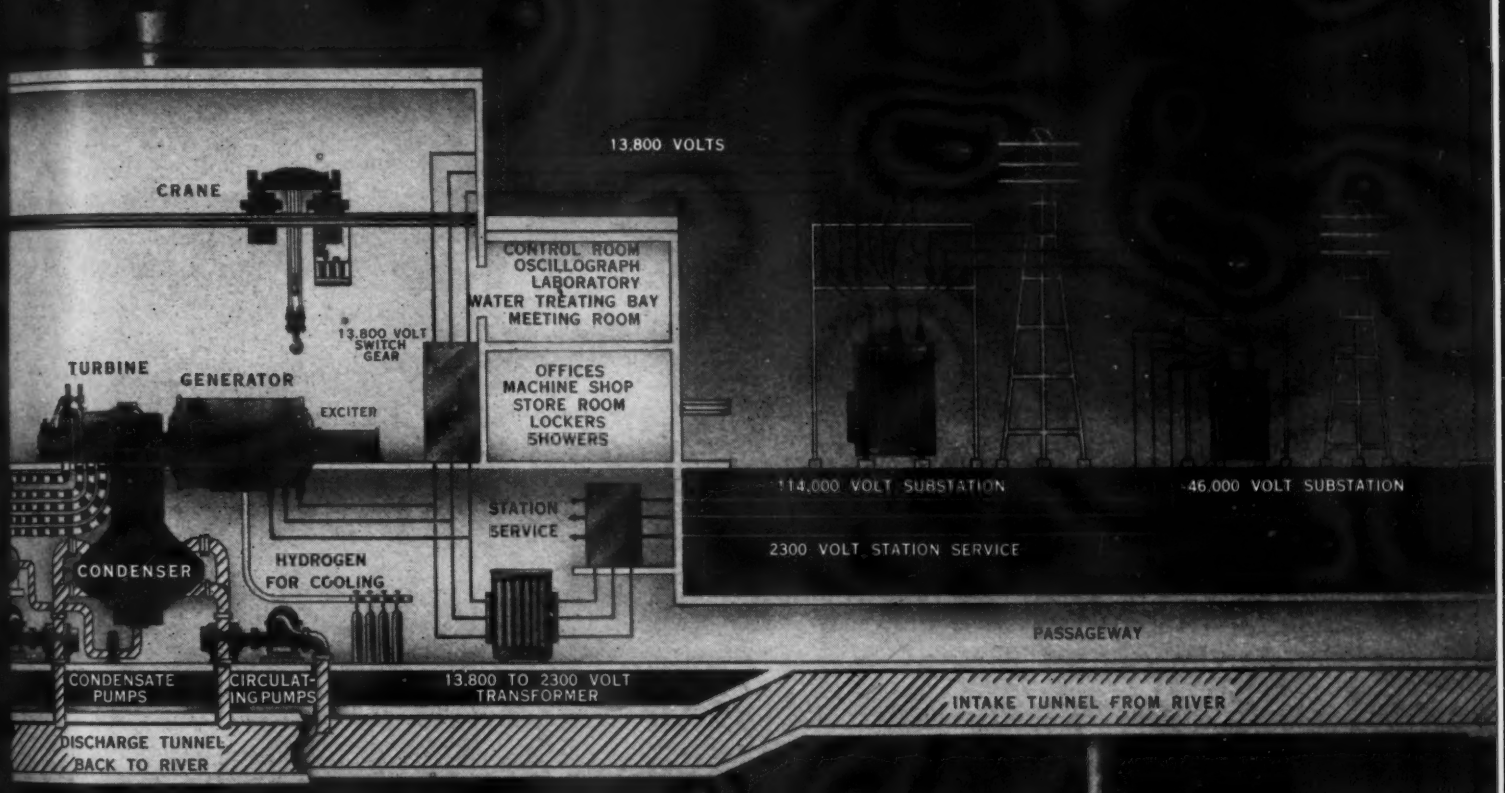
The main equipment at Jennison consists of a 30,000-kw turbine generator, receiving steam at 650 psi and 825 F, and two C-E Steam Generating Units, each rated at 200,000 lb per hr and fired by C-E Traveling Grate


COMBUSTION

200 MADISON AVENUE, NEW YORK 16, N. Y.

# FIRST POST-WAR UTILITY POWER PLANT

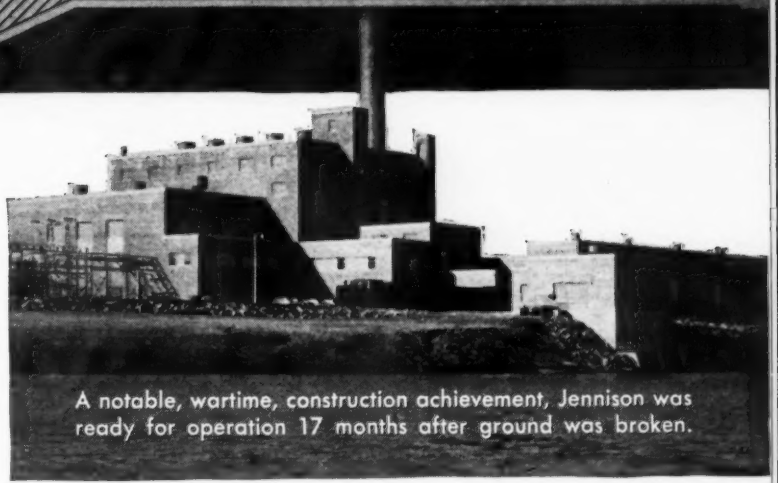
# now in service




Stokers. These stokers, each 24 ft wide by 28 ft long, with 672 sq ft of grate surface, are the largest of their type ever installed in a utility plant. The fuel used is No. 4 buckwheat anthracite.

An impressive example of modern power plant construction, Jennison will contribute materially to system economy and to serving the growing electrical needs of the South Central area of the State of New York. The many interesting features of the station have been described in detail in articles appearing recently in the technical press.

This notable addition to New York's power generating facilities is a result of long range planning and a foresighted new construction program by New York State Electric & Gas Corporation. Executives and engineers of this company were assisted in conception, design and construction of Jennison station by Gilbert Associates, Inc., consulting engineers.



A notable, wartime, construction achievement, Jennison was ready for operation 17 months after ground was broken.

A-947

# ENGINEERING

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

C-E

# The verdict of the Insurance

This incident occurred in a municipal electric plant in an Ohio community. It isn't a large plant—two 312 horsepower boilers, operating at 200 psi. It is one of those plants that seldom appear in the engineering publications but which collectively account for well over half the stationary steam power generated in this country.

There never had been enough trouble with these boilers to make this plant newsworthy. Tubes had to be turbined rather frequently, but it was possible to keep them clean enough to avoid any prolonged interruption of service.

Nevertheless, the engineer in charge felt that boiler water conditioning could be improved, and early in 1945 he started to use the Hall System. Hall engineers made their usual study of water supply and operating conditions, set up the proper procedure, and taught the plant operating personnel how to make the necessary tests.

Periodic check-ups showed that the plant was evidently following the procedure carefully. No troubles developed—and that is, after all, the main objective of boiler water conditioning.

About seven months after the Hall System was started, the inspector for the boiler insurance company paid his regular visit—and his report summed up the results of those seven months.

"I don't know what you've been doing to these boilers," he said, "but whatever it is, keep it up. *These tubes are 100 per cent cleaner!*"

There is nothing spectacular about the story. It is not a startling achievement—just a routine example of our regular job, effectively done. But it is, we believe, just the kind of case history you would like to have for your own plant.

**HALL LABORATORIES, INC., HAGAN BUILDING, PITTSBURGH 30, PA.**

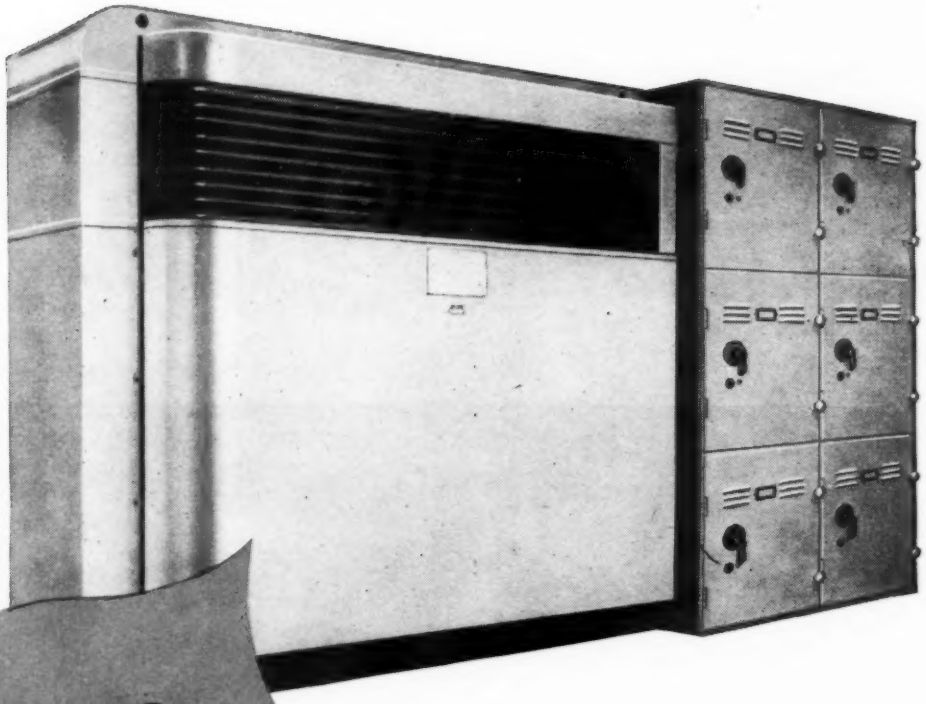
*(a subsidiary of Hagan Corporation)*

HAGAN
HALL
BUROMIN
CALGON

# Inspector...

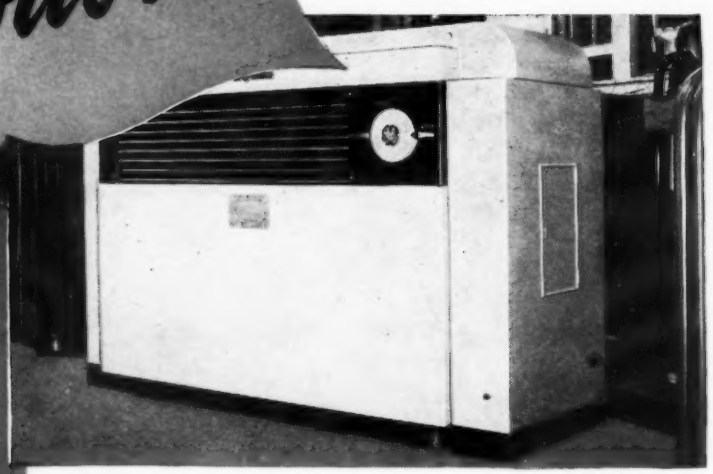
**HALL SYSTEM** *of Boiler Water Conditioning*

A typical G-E dry-type substation, made up entirely of standard elements and equipped with metal-enclosed, drawout air circuit breakers. Units like this can be added one-by-one until your entire plant is converted to a co-ordinated load-center system.



# SOUND DESIGN *inside and out...*

## DRY-TYPE



A "bright spot" anywhere in the plant, this G-E dry-type load-center unit substation (150 kva) is completely self-contained, incorporating high-voltage potheads, disconnecting switch, fuses and low-voltage thermal breakers.

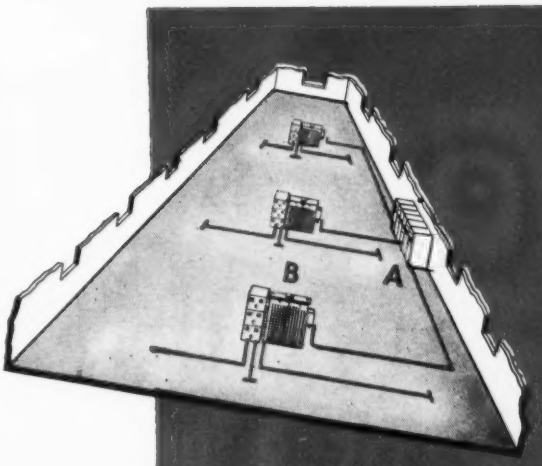
**G-E** dry-type unit substations are styled to meet 1946 requirements for neatness and clean-cut appearance in your plant equipment-layout. Their design simplicity lends itself to ease of location and facility of installation. Their light weight reduces structural problems.

Users who prefer dry-type equipment will find these unit substations at the top of their class in their ability to handle overloads. For, the transformer sections of G-E dry-type unit substations are designed to meet AIEE Standards No. 1 for Class B insulation, with *130 C maximum hot spot temperature* in a maximum ambient of 40 C. They also meet ASA Standards C-57.1, which limit the observable temperature rise to 80 C.

These unit substations have factory-matched switchgear —that is, the interrupting capacity of the switchgear section is matched, electrically, mechanically, and thermally, with transformer characteristics.

G-E dry-type unit substations are repetitively manufactured. This is a feature adding to their flexibility, for as load requirements change, expansion is met by the addition of similarly matched units, block by block. Thus, a planned efficient load-center power distribution system is always in operation in your plant. G-E dry-type unit substations are available in ratings up to 2000 kva, 15,000 volts.

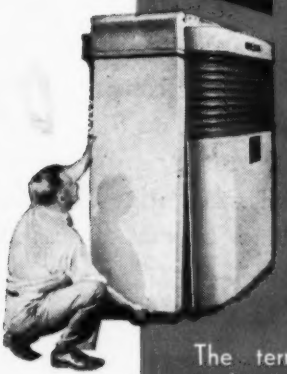
Ask for bulletins GEA-3592A and GEA-3714B. Call your nearest G-E representative or write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*




In a modern load-center distribution system, power is distributed from metal-clad switchgear (A) at relatively high voltage (2.4 to 13.2 kv) to load-center unit substations (B) located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through short secondary feeders.

# UNIT SUBSTATIONS

G-E dry-type unit substations have been supplied in quantity since early in the war-construction period, and sizes and types to meet individual load conditions can now be ordered "right out of the catalog."



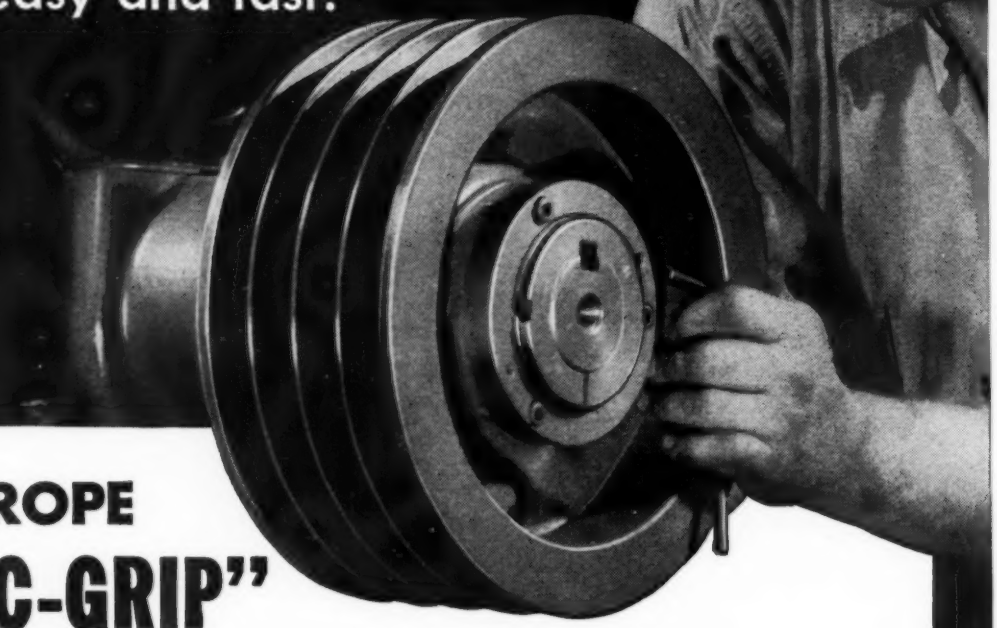
The terminal compartment casing extends down the entire side of the substation, facilitating cable entrance connections. The unit can be moved into place after conduit and cable have been made up. On vital conversion jobs, this convenience feature will save many precious hours.

**GENERAL ELECTRIC**

321-44-5900

# "I Can't Afford Down-Time...

I need a sheave that goes on and off easy and fast!"



## TEXROPE "MAGIC-GRIP"

### ...Fastest Mounting Sheave Ever Made!

Saves manhours...this improved sheave with "Magic-Grip" bushing comes completely assembled. You slide it on the shaft to exact position, tighten three cap screws — and it grips like magic. No filing or scraping, no hammering. And it comes off just as easily!

More advantages: "Magic-Grip" sheave *mounts close to the motor.* Less overhang, less vibration, less strain on bearings. *Clamp fit can't damage shaft.* No wobble, shear or backlash.

You get these advantages without increase in prices! See "Magic-Grip" sheaves — at your nearest A-C district office or dealer. For literature, write to ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

A 2004

**V-BELTS**

TEXROPE complete line — Sizes, types for every power transmission problem and condition.

# ALLIS CHALMERS

## TEXROPE V-BELT DRIVES

*ORIGINATORS OF THE MULTIPLE V-BELT DRIVE*

**SHEAVES**

"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

# There is far more here than meets the eye

★ *In a casual inspection, the many Taylor Forge Nozzles like this seen in big power and process plants simply appear to be sturdy, workmanlike outlets for boilers and pressure vessels.*

*But there is far more to these nozzles than meets the eye, for into their design goes a fund of technical information that is based on more than forty years of research and experience in dealing with the stresses in vessels and piping under pressure.*

IN WeldELLS, too, there is more than meets the eye, for in WeldELLS and our other regular stock welding fittings is reflected this same accumulated "know-how"—this broad experience in designing and manufacturing for full strength.

An excellent example of this is the distribution of extra metal in WeldELLS where stress is greatest. Another, is the tangents which remove the weld from the zone of maximum stress. In fact, you will find evidence of adherence to highest engineering standards and complete mastery of manufacturing methods in all the features listed opposite—features that are combined only in WeldELLS.

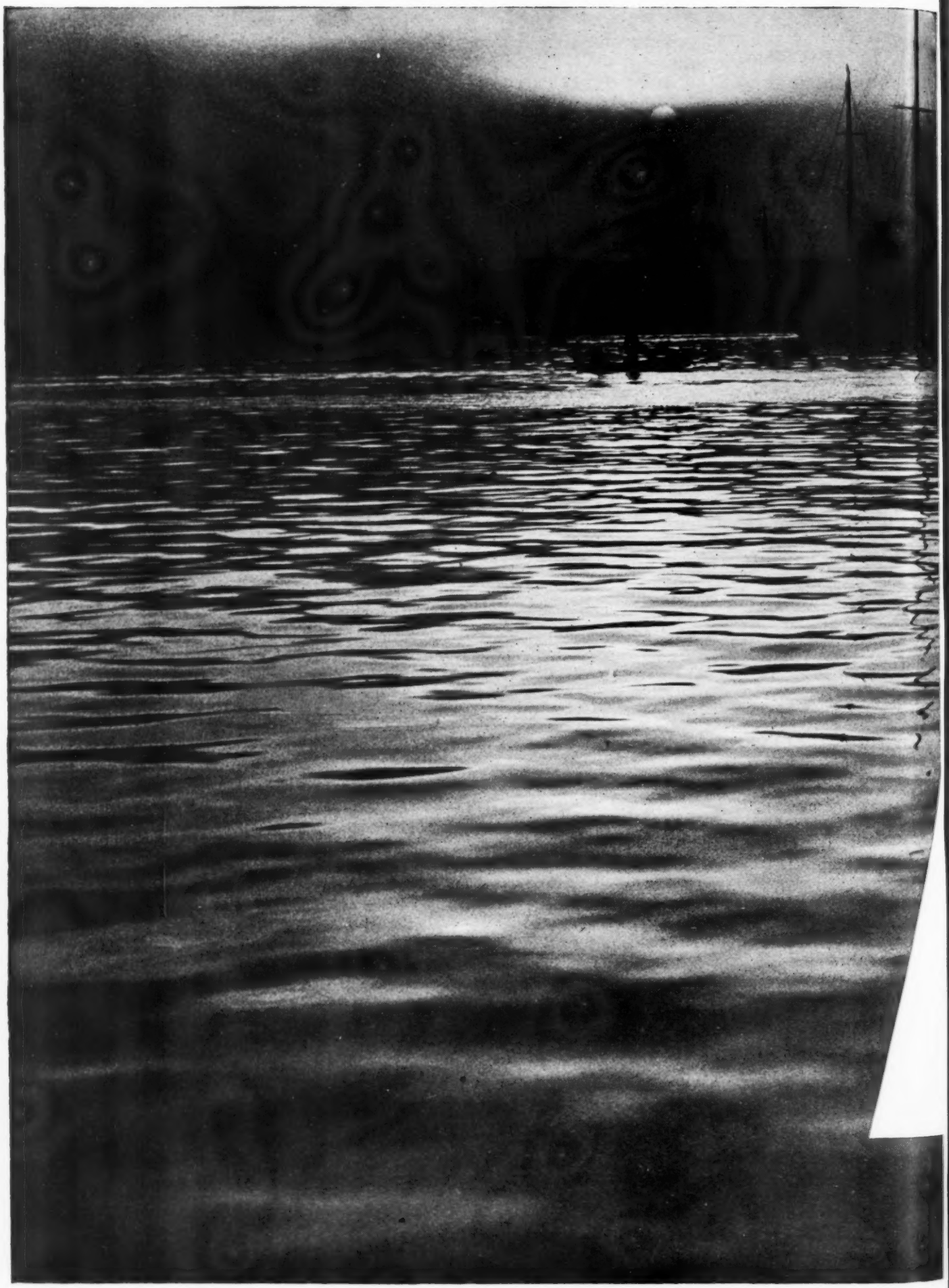
Check this list and we believe you will agree that:

## WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

# WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.



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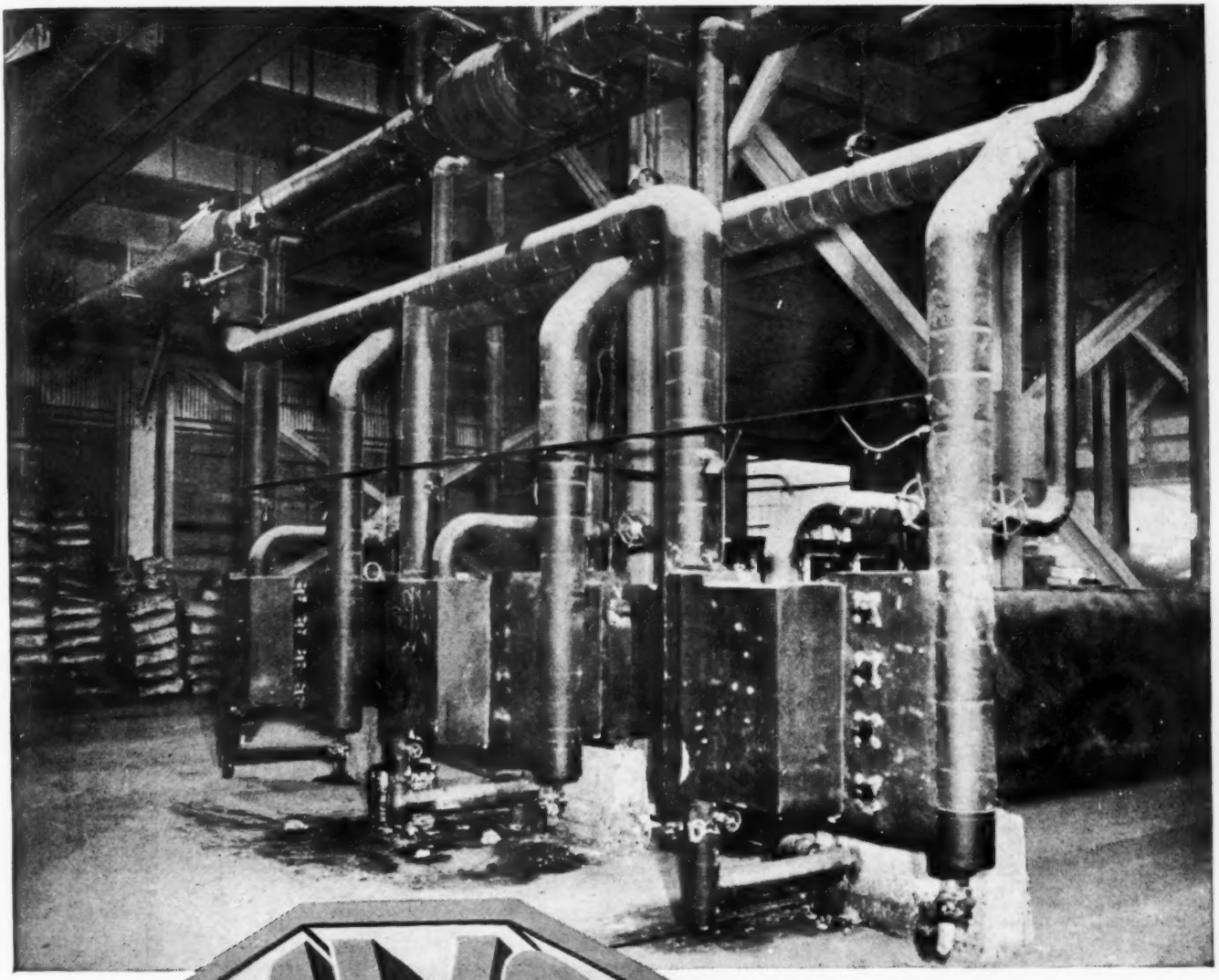

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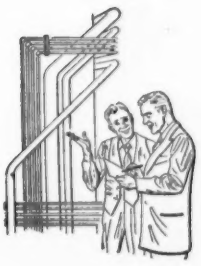

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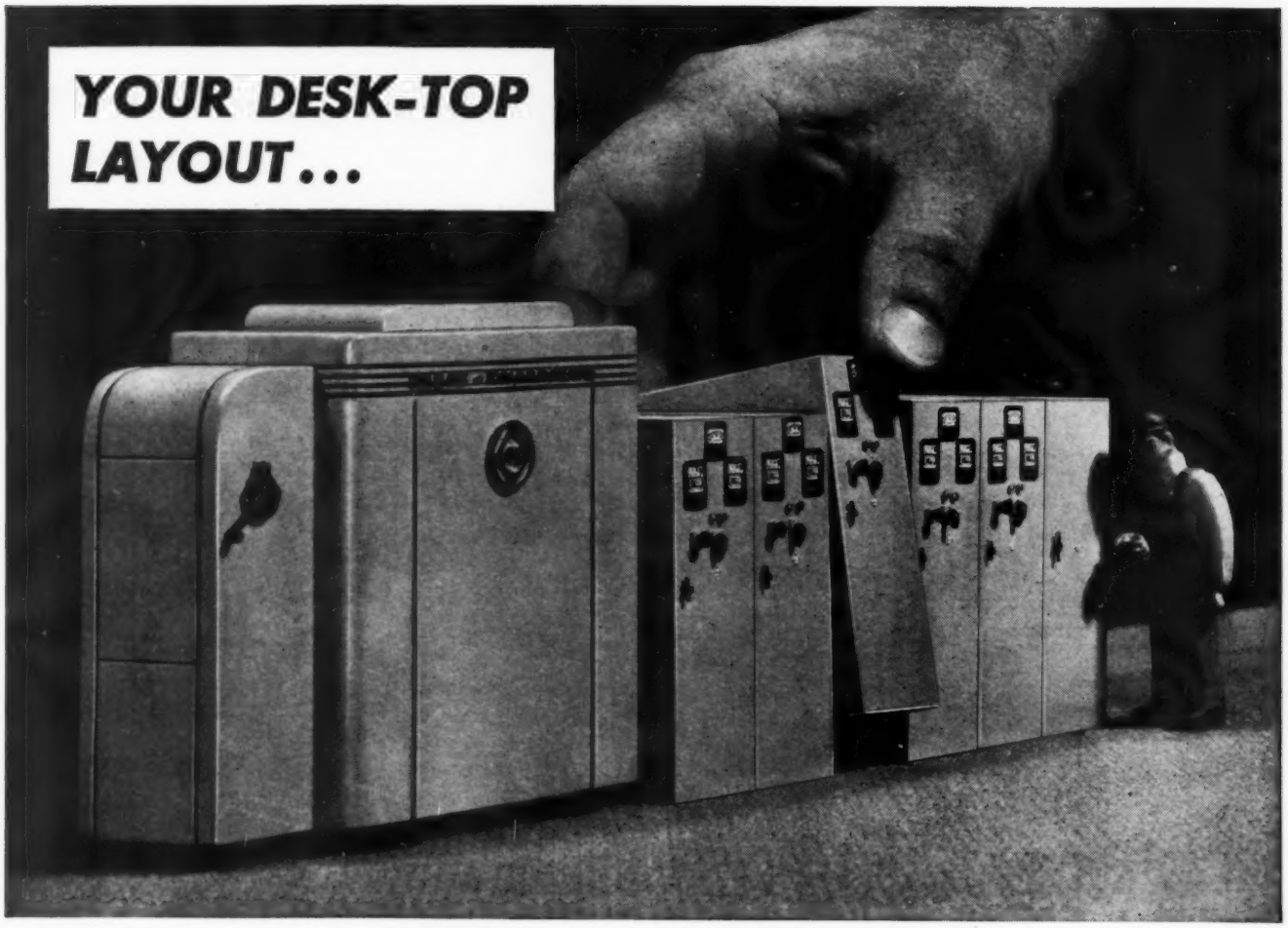


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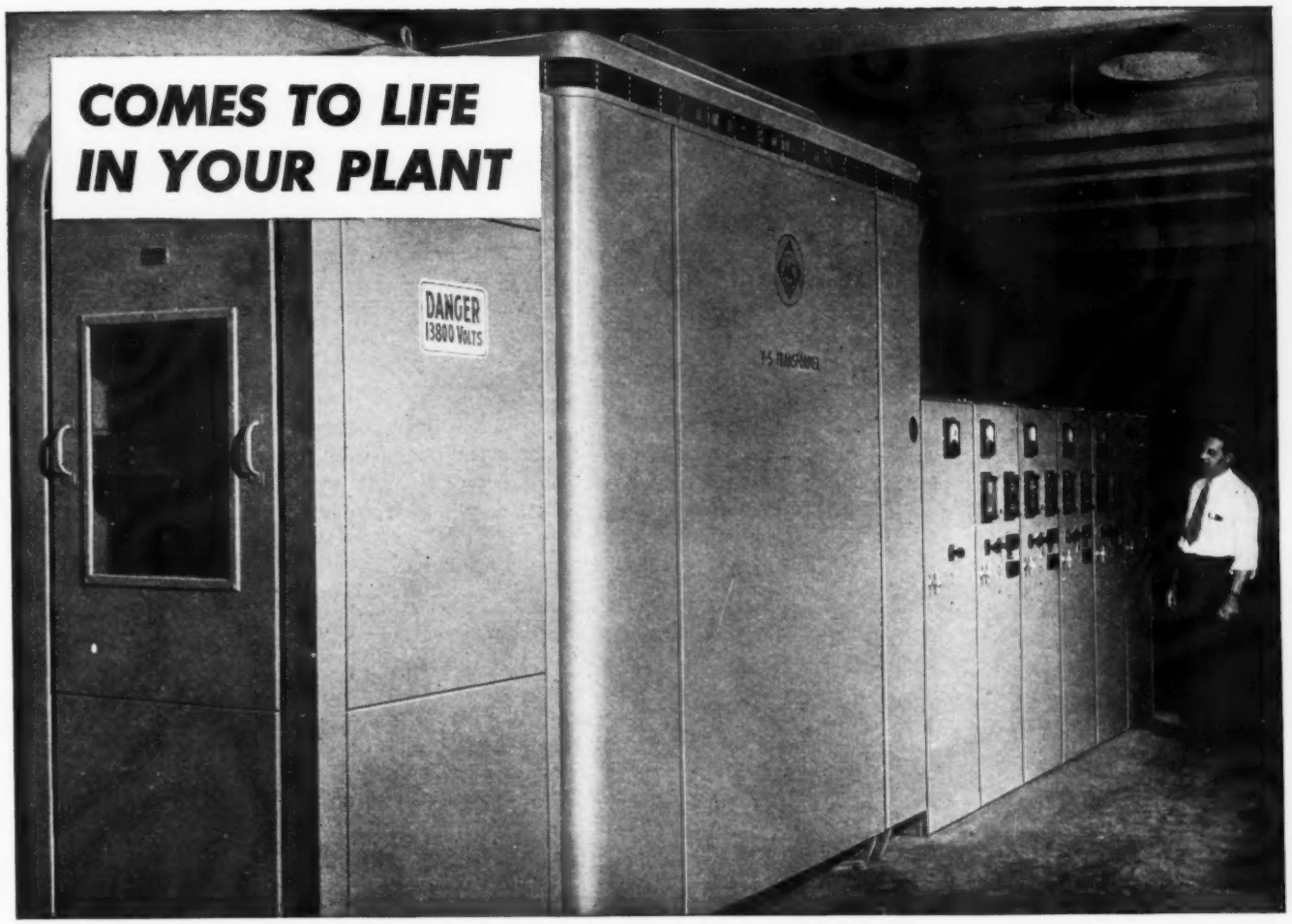


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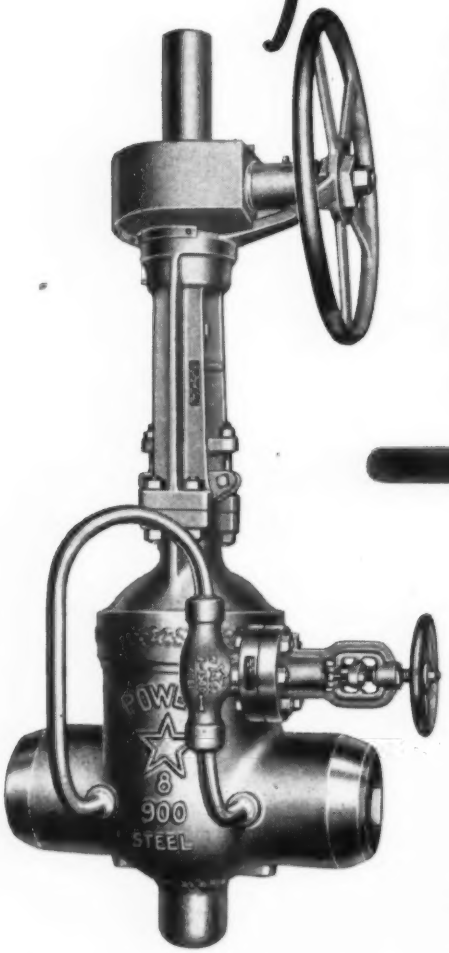
The Powell Line of Bronze and Iron Valves of all types for handling intermediate pressures presents the widest possible selection. And, to meet the modern trend toward high pressure installations, Powell offers a remarkably complete line of Cast Steel Valves for pressures from 150 to 2500 pounds. Powell Cast Steel Non-return Valves, available with spur or bevel gear, toggle or motor operation afford maximum protection for boiler installations. Catalogs on request.




Class 900-pound Cast Steel, Gear Operated Gate Valve with welding ends, welded bonnet and special by-pass.

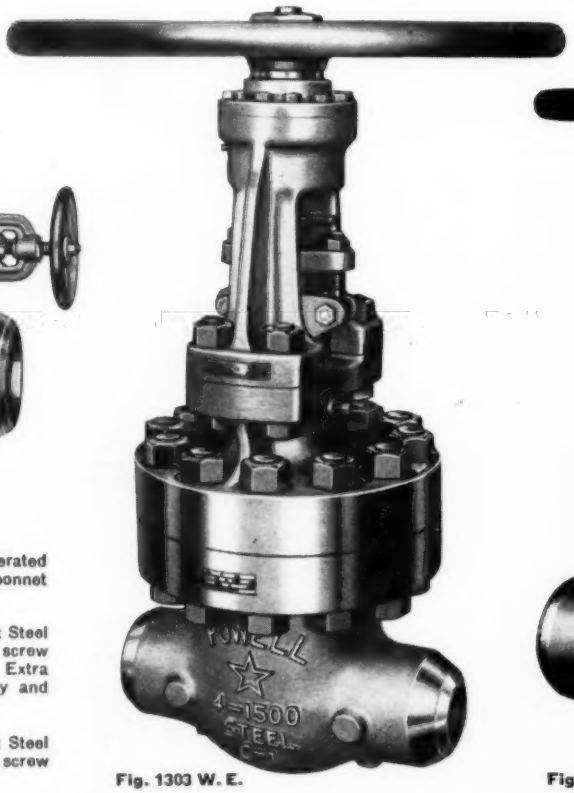



**Fig. 1303 W. E.**—Class 1500-pound Cast Steel Gate Valve, with welding ends, outside screw rising stem and bolted flanged yoke. Extra heavy flanges on yoke and valve body and large hand-wheel for ease of operation.

Fig. 1303 W. E.

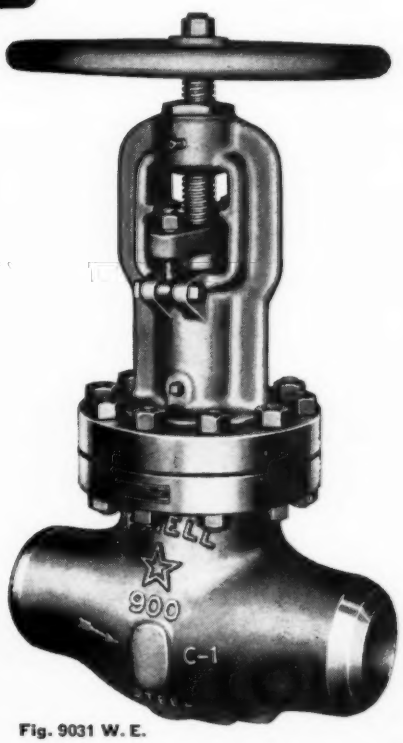
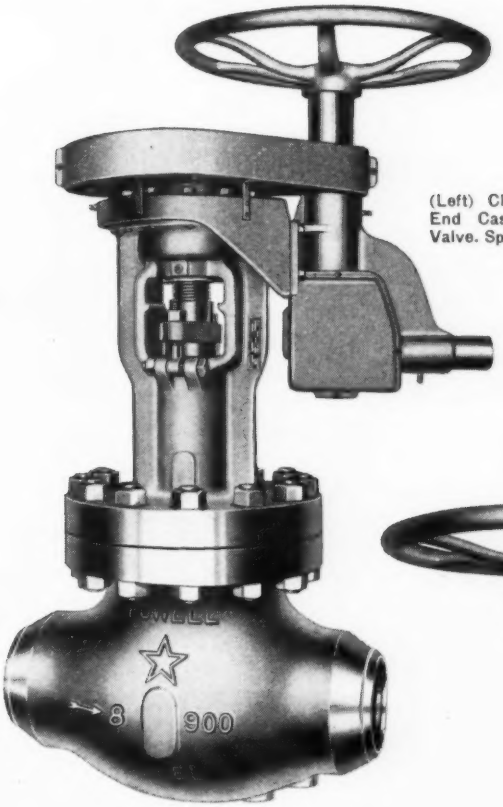



**Fig. 9031 W. E.**—Class 900-pound Cast Steel Globe Valve, with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 9031 W. E.

# POWELL

# in making valves for Power Plants




(Left) Class 900-pound, 8" Welding End Cast Steel Non-return Globe Valve. Spur Gear Operated.

(Left) A Powell answer to the demand for higher pressure and higher temperature flow control equipment. This Class 1500-pound Cast Steel Non-return Angle Valve with welding ends, said to be one of the largest of its kind ever built, has 16" outlet and two 12" inlets. Because of special streamline designing the pressure drop through the valve is reduced to the minimum. Valve is toggle operated.

(Right) Class 900-pound, 10" Welding End Cast Steel Non-return Angle Valve. Spur Gear Operated.

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**Cincinnati 22, Ohio**
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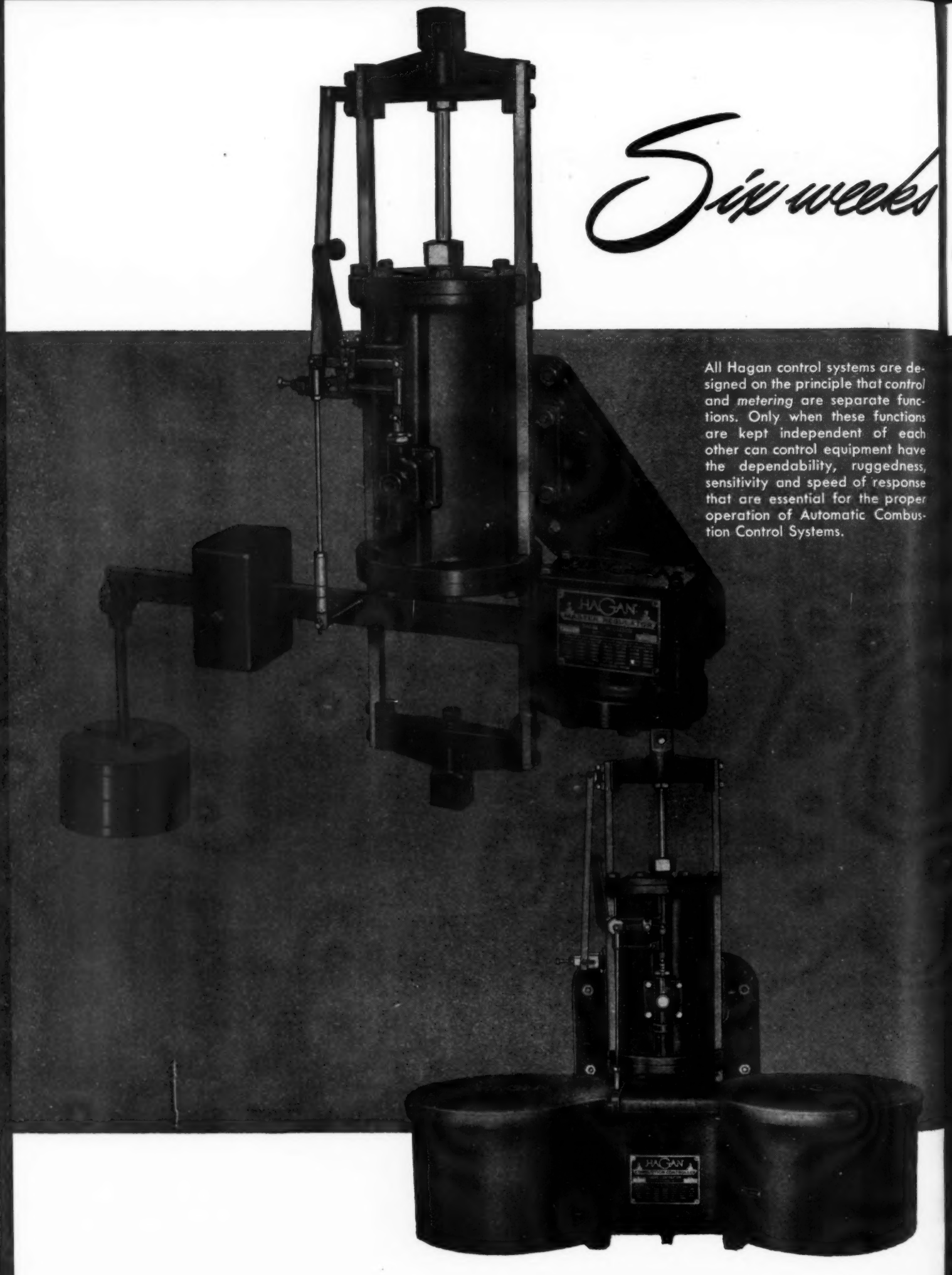
# VALVES


Six weeks
All Hagan control systems are designed on the principle that *control* and *metering* are separate functions. Only when these functions are kept independent of each other can control equipment have the dependability, ruggedness, sensitivity and speed of response that are essential for the proper operation of Automatic Combustion Control Systems.
HAGAN
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# *fuel savings* PAID FOR HAGAN CONTROL

When the new fuel engineer of a Pittsburgh District steel plant called in a Hagan representative, he was worried by something more serious than excessive fuel consumption. He was unable to get steam enough from two 500 hp boilers to meet peak demands of the plant.

Steam is employed in this plant for heating; for atomizing the oil used in the furnace burners; and for descaling and other plant operations. During periods of maximum demand, steam pressure often dropped to such an extent that the efficiency of the furnaces was impaired and operations in the plant were delayed.

An additional boiler seemed to be needed, but that would have required W.P.B. approval and would have involved an investment of nearly $40,000.

The Hagan engineer recommended the installation of a Hagan Master Regulator and two Hagan Furnace Draft Controllers. Total cost—less than $1,000.

That was nearly *three* years ago. During that whole period there has been no difficulty in maintaining constant steam pressure in spite of wide fluctuations in demand.

Furnaces have operated more efficiently, because steam for atomizing the oil is always at the desired pressure.

Delays in plant operations, due to low steam pressure, have ended.

These results more than justified the installation—but they are only part of the story.

Boiler efficiency rose, coal consumption dropped, and savings of more than $25 a day resulted. In six weeks, fuel savings paid the cost of the control system—and that saving has continued ever since. In three years, the $1,000 investment has returned more than $26,000 in dividends!

If you want more efficient boiler operation and lower fuel consumption, arrange to have a Hagan engineer visit your plant. He will be glad to survey it and make recommendations, without any obligation on your part.

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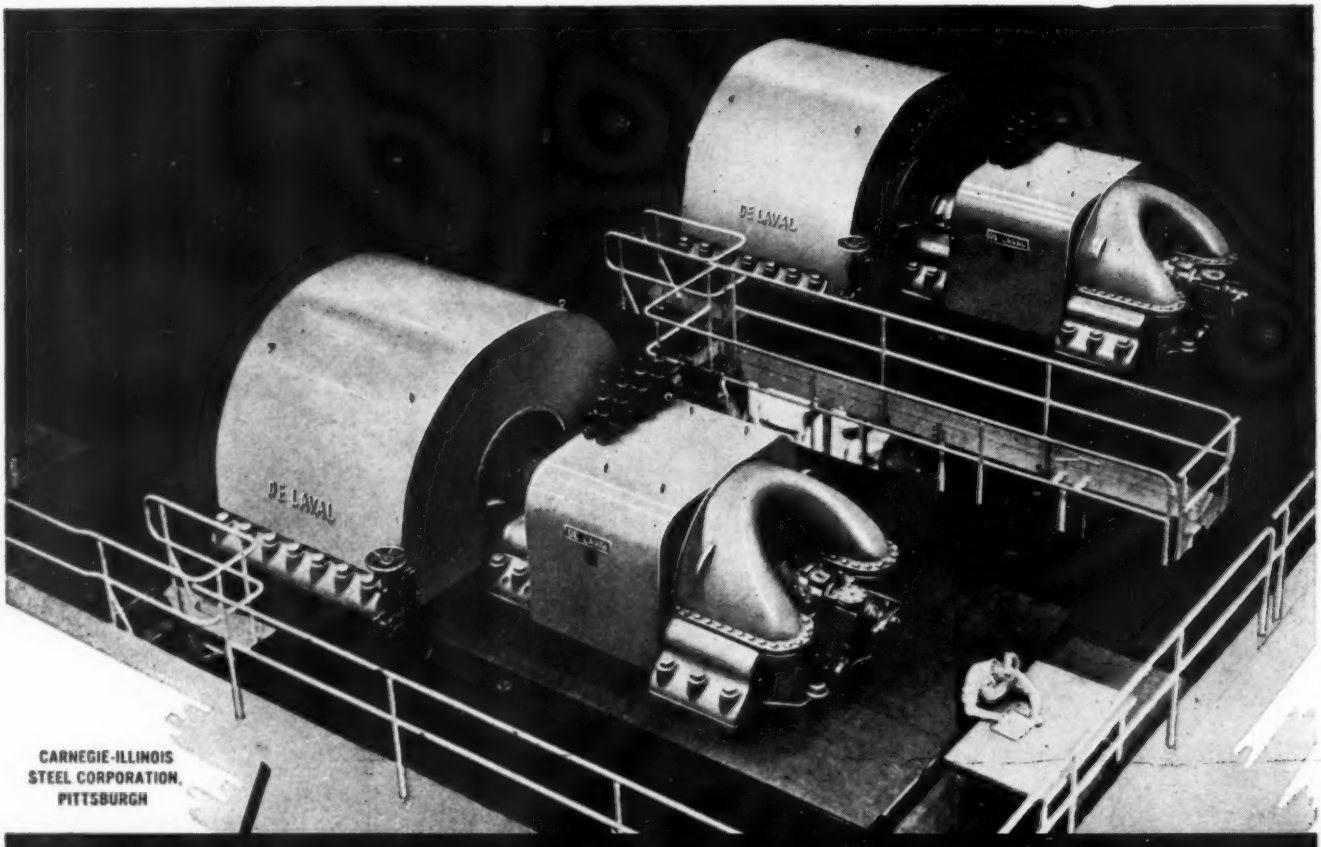


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## by FURNACE EQUIPPED WITH DE LAVAL BLOWERS

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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**THE LINK-GRATE ADDS UP TO THESE 10 ADVANTAGES**

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- Assures accurate control of air flow
- Fuel bed flow is unrestricted
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- Ash discharge is continuous
- Provides high reserve capacity
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The Link-Grate motion maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. Agitation at the rear of the stoker promotes a uniform flow of coal over the underfeed section and keeps the burning lanes open.

Grates first move up to break open the fuel bed and let low pressure air flow through the gates. The downward movement of the grates crumbles and conveys the burning fuel.

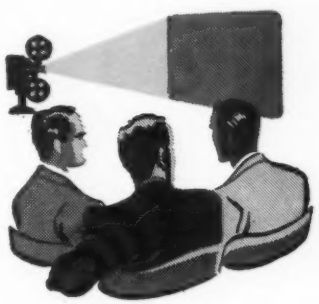
Positive movement of the fuel bed toward the continuous ash discharge eliminates periodic dumping and reduces labor. Clinkers are no problem. Link-Grate motion prevents closed pores in the fuel bed and eliminates the cause of large clinkers.

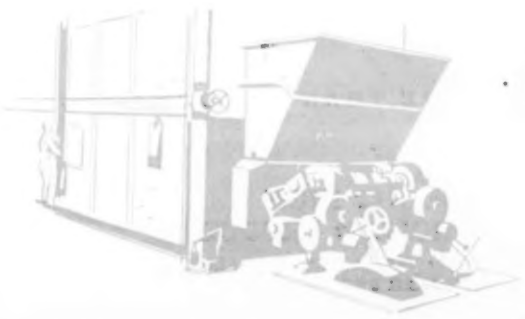
So, before you make another investment in stokers, be sure you have complete information about the Link-Grate. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a present user. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-50464

## SEE A LINK-GRATE DEMONSTRATION IN YOUR OWN OFFICE

Almost invariably, when a stoker buyer sees a Link-Grate in action he becomes a user. Realizing the difficulty that is often encountered by an individual or group in visiting a stoker installation, Westinghouse has prepared a new 15-minute, 16-mm sound movie, showing in detail the operation of a Link-Grate Stoker. Prints of this picture are available on loan for your private showing. Just address your request to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.



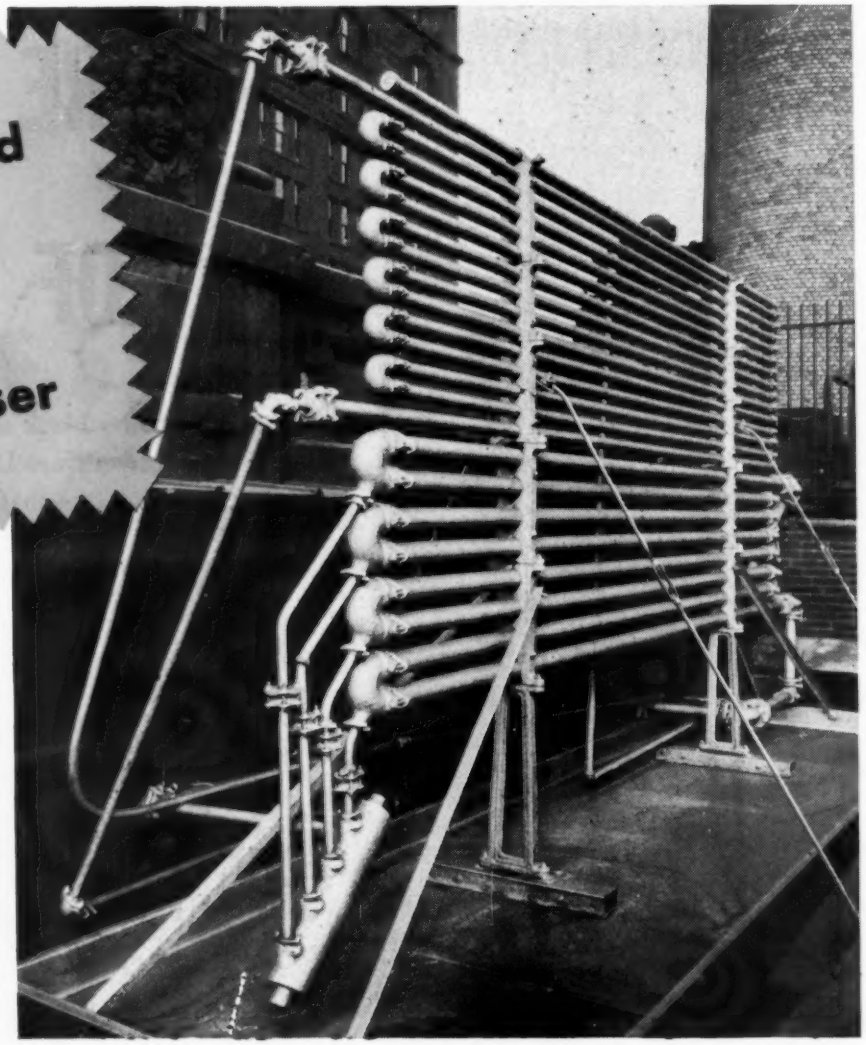


WESTINGHOUSE

Link-Grate STOKERS

# BYERS WROUGHT IRON

## was appointed to succeed itself in this condenser



This combination horizontal atmospheric and bleeder-type condenser is located on the roof of a power plant in a large industrial city, and exposed to highly corrosive atmospheres. When the time came for retubing, the engineers didn't need an exhaustive study to select the right material, for the old tubing provided the best possible guide. It was wrought iron, and had served continuously for 20 years. Byers Wrought Iron Pipe was used for the job.

If any further evidence had been needed, two other stands located on the same roof would have provided it, for the wrought iron previously installed in them had lasted for 25 years.

Reports from users all over the country very definitely indicate that wrought iron can be expected to serve longer, at lower cost per year, in condenser services. An investigation of the histories of 32 condensers, 16 tubed with wrought iron and 16 tubed with ordinary materials, demonstrated this very dramatically. The minimum life of wrought iron was 14 years, and the maximum 35 years, with an average of 19. The minimum life of the low-first-cost material was 4 years, and the maximum less than 15, with an average of 8. Since only a short period of extra service is required to cancel out the extra cost of wrought iron, the savings are substantial.

There is a very definite reason why wrought iron serves so well in condenser service. It is found in the unique nature of the material. Tiny fibers of glass-like silicate slag are threaded through the body of high-purity iron. These fibers act like baffles, to halt and disperse corrosive attack, and so discourage the pitting that causes vulnerable materials to fail. In addition, the fibers help to anchor the initial protective film, which shields the underlying metal. Since no other metal duplicates the composition and structure of wrought iron, no other metal can duplicate the resultant properties of the material.

If you are contemplating the retubing of old condensers or the building of new ones, you will find some helpful information in our bulletin, "Wrought Iron in refrigeration and air conditioning systems." It is important to remember, also, that wrought iron is available now, in any quantity, for any project.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco, Atlanta.

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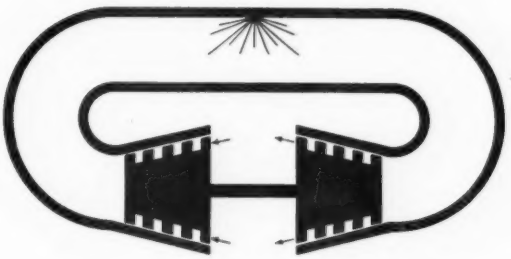


# Gas-Turbine Progress

AT LEAST FIVE REASONS can be given for the amazing progress of gas-turbine engineering: (1) the teamwork of many brilliant designers (2) the solid financial and moral backing of leading manufacturers (3) governmental interest in gas-turbine power for ships and airplanes (4) free national and international exchange of technical information (5) a broad foundation of practical experience with steam turbines, diesels, compressors, super-chargers, heat exchangers and severe-service metals.

Here are some achievements and prospects: The temperature limit for commercial long-life gas-turbine power plants has now reached 1350 F and may soon rise to 1500 F. Part-load efficiency has been greatly improved by such devices as the positive-displacement rotary compressor for open-cycle plants and by adjustable pressure for closed-cycle plants.

Development work on the "coal atomizer" and the coal-burning gas-turbine locomotive is well advanced, with fair promise of success. This may clear the way for the internal coal firing of gas-turbine land plants.

Meanwhile other ways to burn coal in gas turbines are now known to be mechanically workable: closed-cycle air heaters fired by stokers or pulverized coal and internal firing by producer gas made from coal.

When the editor of POWER visited the Leipzig Fair in 1936 he reported the wide use by the Germans of efficient low-cost, free-piston diesel air compressors. The free-piston compressor may soon emerge as an essential element of the most efficient thermal power plant yet produced. An ultimate over-all efficiency of 50% is predicted for the combination of a free-piston compressor and a gas turbine driven by the exhaust.

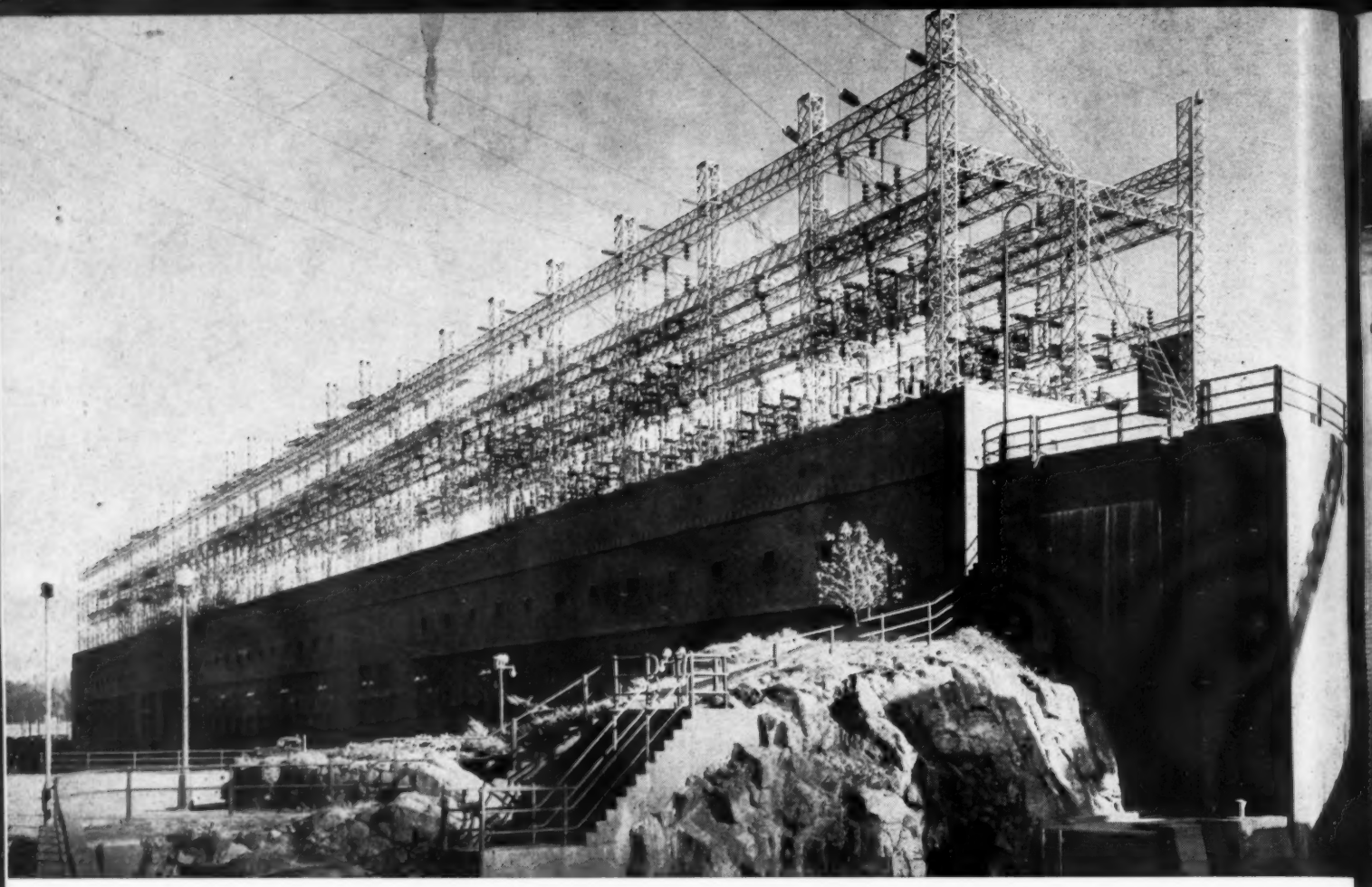
The first plants will run on diesel oil, but there is no basic reason why they cannot be adapted to producer gas, thus combining the most efficient cycle with low-cost fuel.

These are random samples of things in the wind. The whole gas-turbine field is alive with new ideas and new combinations of old ideas. Great things may be expected.

Yet a note of caution must be sounded. The steam turbine is *not* on the way out. As coal-burning gas-turbine central stations are perfected they will compete, not with today's steam stations, but with an improved variety developed to meet the new competition.

In the industrial field the position of the steam turbine will be even stronger. Where the power load can now be generated as a by-product of process steam no other known type of power unit can compete with the back-pressure bleeder turbine in first cost or in over-all fuel economy.

It must be granted, however, that the gas turbine has an important future for such special industrial applications as Houdry-process oil cracking, blast-furnace blowing, waste-gas utilization and for generating large blocks of power where process heat demands are relatively light.



Bonneville powerhouse is 1024 ft long, 207 ft wide, 211 ft high from the lowest point in its foundation, which is 84 ft below mean sea level. The plant has two 60,000-hp and eight 74,000-hp 75-rpm kaplan turbines operating at a 60-ft head

# Seven Years' Operating Experience at

***How 724,000-hp capacity is regulated during floods and low water for maximum power, how pitting of runner blades from cavitation is repaired with stainless-steel welding, and how large salmon runs are handled over the dam in the fishways***

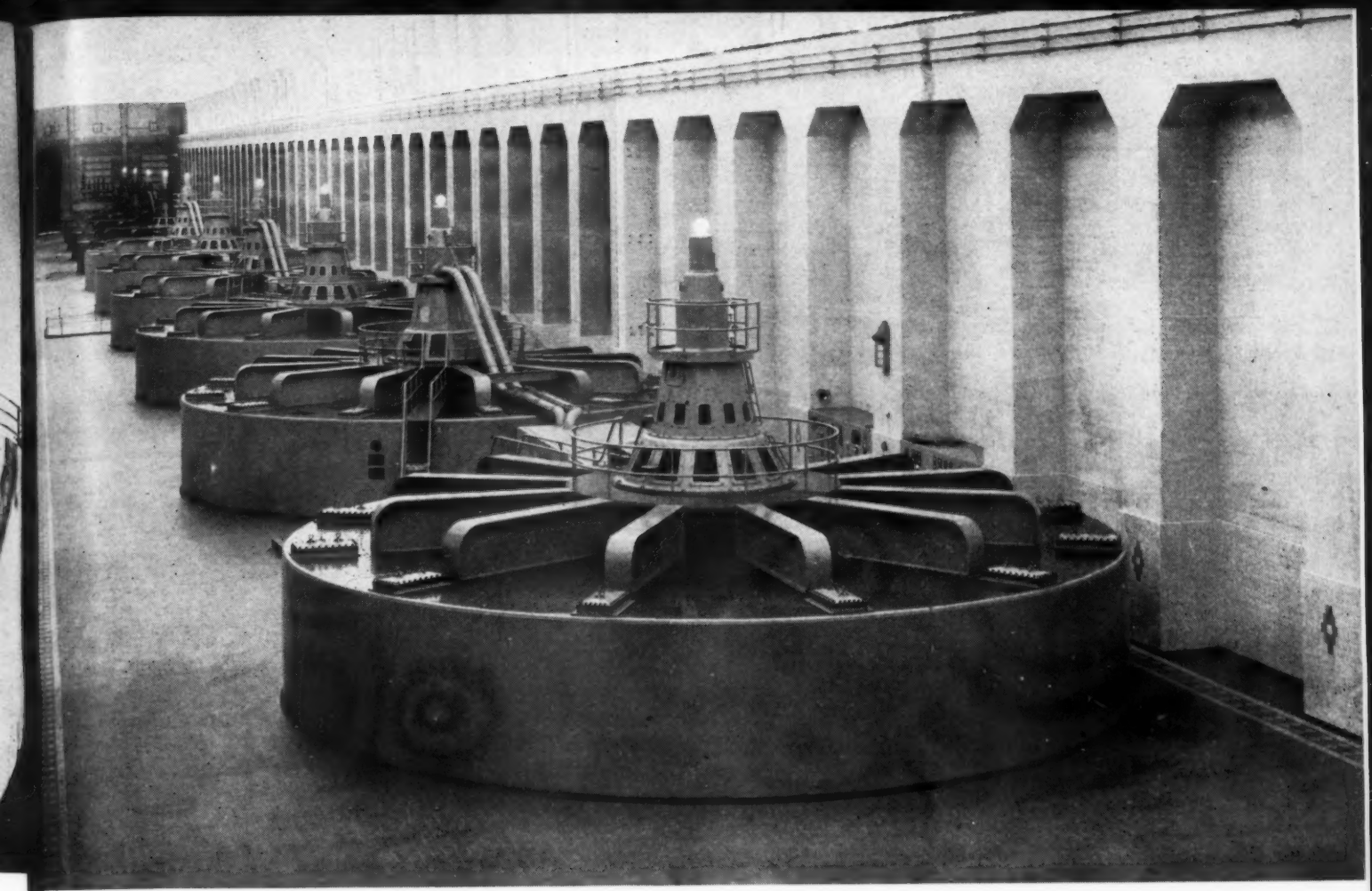
▶ The Columbia River, with tributaries in the states of Montana, Wyoming, Idaho, Oregon, Washington, and in Canada, is one of the world's great sources of waterpower. On this river the federal government is building several huge hydroelectric plants, of which Bonneville is the first to be completed.

Seven years have elapsed since the first main unit at Bonneville went into service, and almost two years since No. 10, the last one, began operation. In these seven years, with other units added at intervals, there has been ample opportunity to evaluate the accuracy of design criteria, and determine to what extent provisions to cover special conditions have met with success.

This plant, which has ten units of 724,000-hp total capacity at 60-ft head, is located 42 miles east of Portland, Ore., at tidewater. Here Bradford Island divides the river into two channels. A spillway dam with 1,600,000-cfs capacity spans the north, or main channel, while across the south channel the powerhouse is in effect a nonspillway dam. It is 1024 ft long, 207 ft wide and 211 ft high from the lowest point in the foundation, which is 84 ft below mean sea level. Two 300-ton cranes, each with two 150-ton hooks, travel the full length of the powerhouse. A lifting beam connects these cranes for the maximum lift, the 550-ton generator-rotor assembly.

At times the river is filled with ice moving downstream, and spring floods carry large quantities of drift varying from bark and brush to 100-ft trees. An ice-and-trash sluiceway with 2400-cfs capacity, which passes logs up to 30 ft long, extends along the power plant's upstream face. It can be opened to pass this drift downstream through the plant's south end. Operation has been highly satisfactory.

During maximum river flow, tail-water level may rise to where the normal 54-ft head at the plant is reduced to 23-ft. Maximum head during low-stream flow may reach 69 ft. To compensate for high tail-water level during high flow, powerhouse design permits raising normal headwater level 10.5 ft, that is, from forebay elevation 72 to 82.5, Fig. 4. During the war emergency advantage was taken of this provision in low-water periods to increase the plant's output by raising the forebay's level 6 ft above normal. This has increased low-water output about 10% during the last three years when power was badly needed.



Interior showing the ten generators, two rated 48,000 kva, 0.9 pf, and eight 60,000 kva, 0.9 pf. Power from them goes through step-up transformers into a 2700-mile 115- and 230-v transmission network that serves the Pacific Northwest

# Bonneville Hydroelectric Plant

To take full advantage of high flow at times of minimum head, and high head at low flow, and to maintain high efficiency at different load conditions, kaplan turbines were selected. Their runners are 280 in. in diameter, have five blades with the blade-angle adjusting mechanism submerged in oil in the runner's hub. Oil pressure in the hub is maintained about equal to that on the outside, keeping leakage from the hub to tail-water down to only a few gallons per month per unit.

Turbines No. 1 and 2 are rated 60,000 hp at 50-ft head and connect to 48,000-kva 0.9-pf generators. Turbines No. 3 to 10 are rated 74,000 hp at 60-ft head and drive 60,000-kva 0.9-pf generators. For all units the turbines have like characteristics and are duplicates except that the two smaller units have 39-in. shafts and the eight larger ones 42-in. shafts.

Cast-steel runner blades of No. 1 turbine were machine finished to a true theoretical shape determined by the designers. All the other runners have cast-steel blades but are finished only by hand grinding to a smooth surface. Units No. 1 and 2 being identical gave an opportunity to judge whether smooth-finishing the blades improved turbine performance and reduced effects of cavitation enough to justify the extra expense of machining the blades' surfaces, under Bonneville conditions. Seven years' operation of these two units under practically identical conditions has developed no observable difference in either smoothness of operation or maximum output.

On the first four units, underside of blades has a stainless-steel insert deposited by arc-welding over the area indicated in Fig. 2 and 3. This insert is about ¼ in. thick and ground smooth with the blades' surface. Size of inserts on the blades of units 5 to 10 was increased to include areas on which minor effects of cavitation had developed on units 1 and 2. Cavitation effects on these two units during their first year's operation under light load consisted of a few small scattered holes about the size of a pencil point and ⅛ in. deep. These occurred over small areas adjacent to the stainless-steel insert on the blade's leading edge, Fig. 2. On units 1 and 2 no difference could be noticed in pitting which did not progress to where welding was needed until 1943.

After the first year's operation load increased rapidly, and from 1940 to 1944 the plant continuously carried 108% of machine's nameplate rating. Additional units were loaded as fast as they could be installed until No. 10 went into service, Dec 1943.

Because of the higher ratings of units 3 to 10 and the overloads they carried for long periods, cavitation effects, as indicated in Fig. 3, were more severe on their turbines than on units 1 and 2. This was to be expected because turbine-water passages on all units were the same, resulting in higher velocities for the larger machines. Cavitation pitting even with maximum permissible overload is not a serious problem.

Pitting on each turbine is now sched-

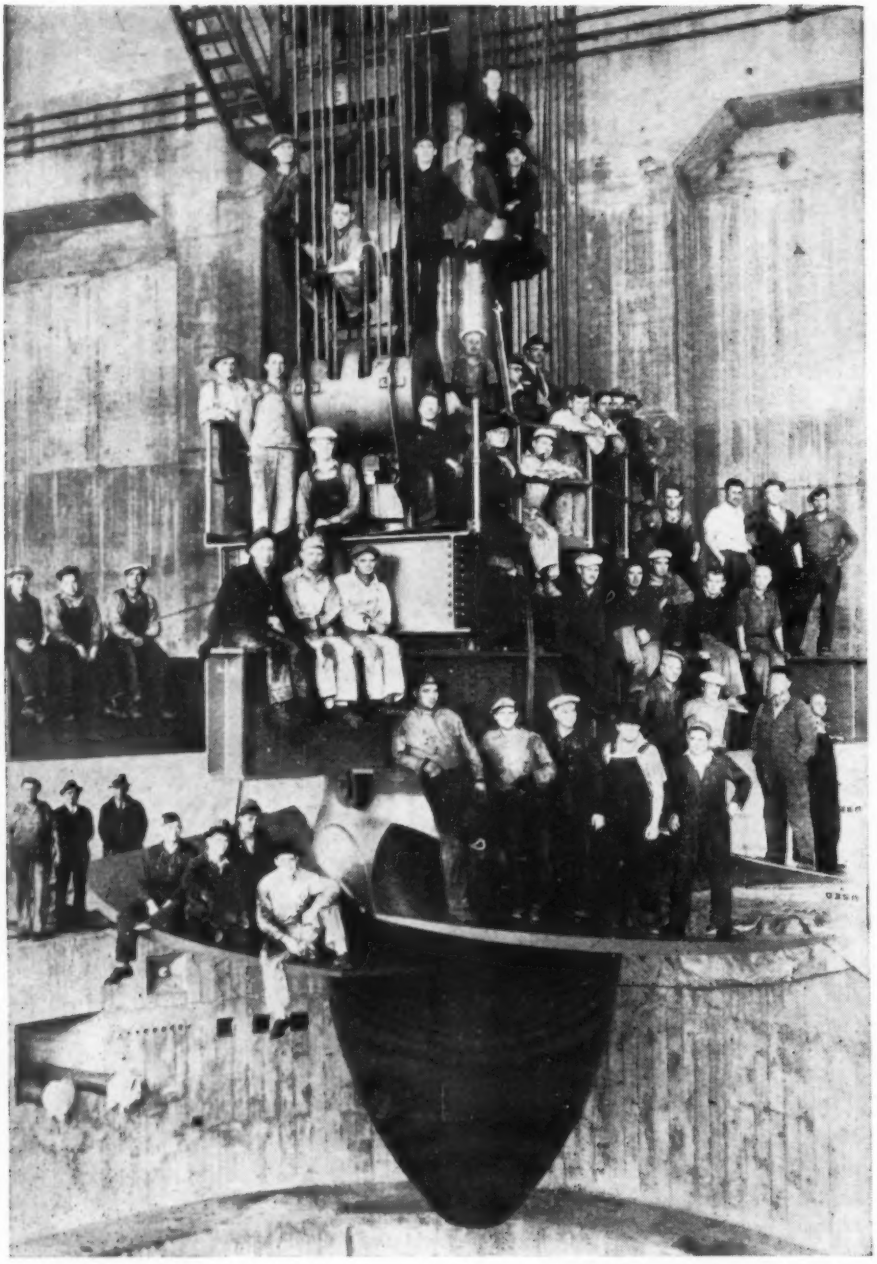


Fig. 1—Two 300-ton bridge cranes, each with two 150-ton hooks, travel length of the powerhouse. Here they are lowering a turbine runner, 23 ft, 4 in. diameter

uled for welding every second year with stainless steel. Practically immune to pitting under Bonneville conditions, it will decrease the amount of welding rapidly with succeeding repairs. Under present conditions after 20,000 hr operation, blades on each turbine are pitted over an area of about 2000 sq in. and from $\frac{3}{8}$ to $\frac{5}{8}$ in. deep.

Preparation for welding of pitted areas on the turbine blades is equally as important as welding and finishing the blades' surfaces. With proper equipment, grinding out the pitted areas preparatory to welding is faster than chipping. Grade, grit and speed of grinding wheels are most important. Adjustable grinding rests not only prevent operator fatigue but also provide a fulcrum to maintain correct pressure for efficient grinding.

All pitting is removed to its greatest depth and small areas close together are joined to prevent pitting between them. Edges of prepared pockets to be filled by welding are beveled to a 45-deg angle to insure good joint fusion between stainless steel and parent metal.

Since pitting occurs on the blades' underside only, welding must be done overhead. To favor the welders, the blades are set at their maximum open angle of 32 deg, to position them as nearly vertical as possible. Arrangement of scaffolding and fixtures is given careful attention to assist the welder, whose work is done in an awkward position.

Welding rods are $\frac{1}{8}$ in. in diameter, of shielded-arc 18-8 stainless steel with a 0.07% maximum carbon content. Length of center grip rods is 18 in., as the varying resistance of longer rods makes it difficult to obtain a uniform welding deposit.

Welding metal is deposited horizontally starting from the cavities' bottom side and working upward. Single stringer beads are applied with no weaving of the electrode and without break in the arc until the allowable amount of rod is deposited. Welding is done on a skip sequence to keep blade temperature as low as possible at any area being repaired.

Not less than two bead layers are applied because carbon pickup from the parent metal is sufficient in the first layer to reduce its resistance to pitting. This type of weld is not peened. After a cavity has been welded full a cover bead is run around the area's outline to improve fusion between the stainless-steel fill and the parent metal.

Only small quantities of welding rod are brought into the wheel pit at a time because coating on the rods absorbs moisture and unfits them for use. They are kept dry in a small heated space until needed.

Finished welds are ground with wheels carefully selected as to grade, grit and speed. They are kept clean and free of metal that might contaminate the stainless steel. Welded surfaces are finished with fiberback abrasive disks to make them as smooth as possible.

### *Fishway Operation*

Necessity of providing for the annual salmon and other fish runs through the project was a major problem in planning Bonneville Dam. In the Columbia River area the salmon industry amounts to an estimated $10,000,000 annually. Hence, every precaution was taken to insure minimum interference with adult salmon passing upstream, and fingerling salmon downstream.

Before Bonneville was constructed, not a great deal was known of the salmon's habits. Fish ladders on smaller streams consisted of a series of pools, not more than 10 ft wide, whose levels varied from 12 to 30 in. in different ladders. Weirs, over which water poured from one pool to the next, were from 2 to 3 ft wide. Salmon moved up such ladders successfully, but it was known that there was a limit to the overall height to which they would go.

Magnitude of the run in the Columbia

was not known nor how many salmon might be expected to pass a given point in an hour at the run's peak. Lacking this information, the main ladders' width was fixed at 40 ft to insure plenty of room for the salmon's movement at the peak, and to provide large pools in which they might rest during the passage. Difference in levels was fixed at 1 ft, the weirs extending the full width of the pools. In addition to the weirs over which the salmon pass, openings through which they may also go were left near the bottom of the walls between pools. A sheet of water about one foot deep pours over each weir and the fish swim easily upstream over the weirs without breaking water. At times playful fish can be seen jumping over the weirs, high above the water.

At one location in each fish ladder is a counting station where space for fish to pass upstream contracts to a narrow opening 30 in. wide. An operator watches each opening and with a counter records the number of each kind of fish passing upstream. During the peak of the run, counting stations operate day and night but at other times, during the day only, and not for more than an hour per day, if a small number of fish are moving.

### *Mechanical Equipment*

Mechanical equipment used with the ladders consists of revolving screens, through which an auxiliary water supply passes, and control valves. This water taken from above the dam flows down to a point near where the fish going upstream enter the fishway. Here the water enters through diffusing screens, being added to the water in the fishway to increase the amount discharged and provide a greater attraction for the fish. This method controls more effectively the water discharged through each opening where fish enter. The elaborate provisions are justified by the successful operation of the fish ladders. On Sept. 9, 1942, 51,082 Chinook salmon passed Bonneville counting stations in a single day of the fall run.

Notwithstanding all the provisions, no certainty was felt that the passage of fish through the ladders could be made without difficulty. If they became tired they might be inclined to stop in the pools, and not move farther upstream. To insure their passage if they refused to go up the ladders, two fish lifts were installed for each fishway intake area, and water passages arranged to guide the fish to the lifts. Each lift consists of a 20x30-ft lock in which gates can control the water level. With fish-lift water level down to tail-water, fish enter the lock above a screen that rests on the lock's bottom. The gate is then closed and the pool raised to headwater level after which the screen is lifted, raising the fish up to near forebay level. The fish can now go into the forebay, but if they are not inclined to, the screen level is raised slightly, and as it slopes toward the upstream exit, they depart readily.

Except for minor mechanical difficulties that were easily remedied, the fish lifts work satisfactorily, and those in charge of the fishways believe that the entire salmon run could be passed upstream in this way.

Because the ladders are satisfactory, continuous operation of the fish lifts has been unnecessary. However, during the season of 1941-1942 the two fish locks at the south end of the powerhouse passed 124,823 salmon, when the regular fishways were out of service because of new construction. At present the fish lifts are not operating but are kept as standby.

Small salmon, it would seem, find their way downstream through the dam and turbines without difficulty. However, so far as is known they do not ordinarily go to great depth, preferring to remain near the river's surface and shores. To meet this tendency, fingerling bypasses are provided. These miniature fishways have an intake near the upper-

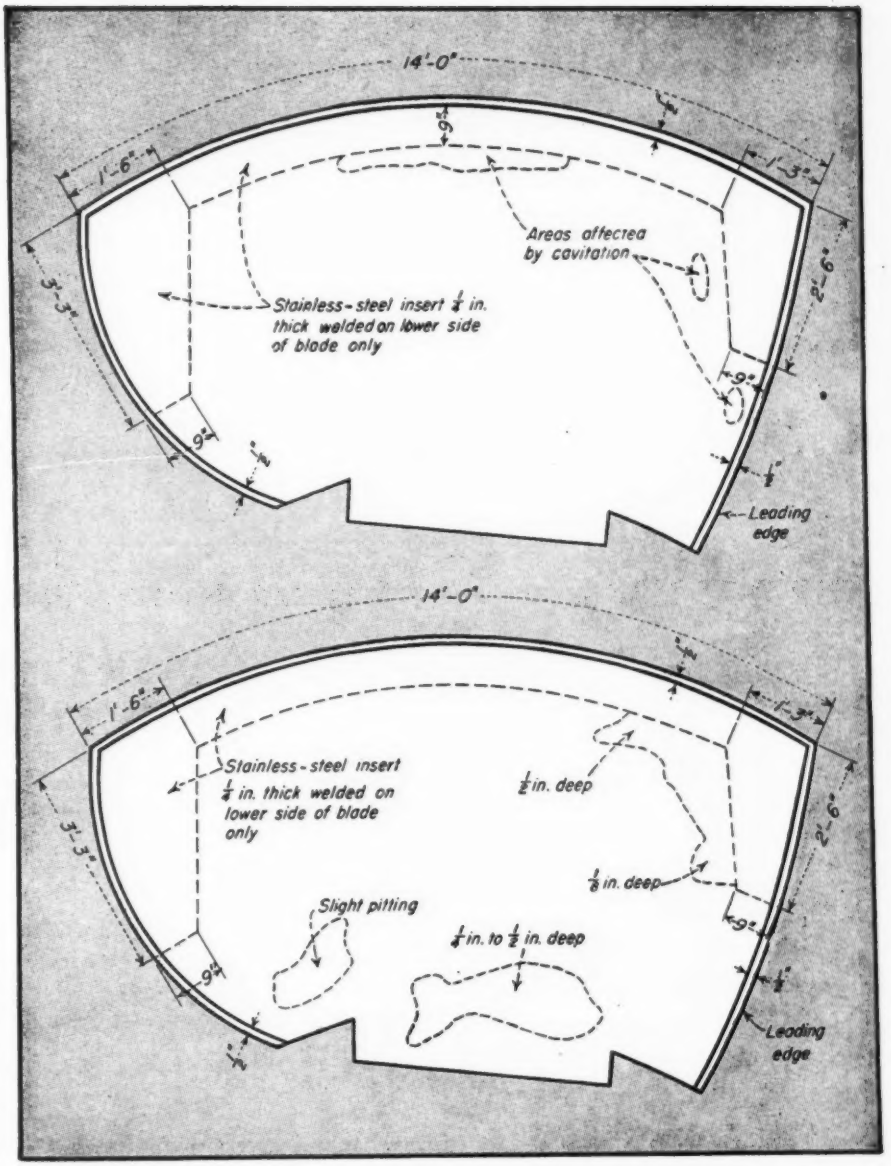



**Fig. 2 (top)—Diagram of cast-steel runner blade with stainless-steel insert, about 0.25 in. thick, welded on blade's underside to resist surface pitting by cavitation**

**Fig. 3 (bottom)—Diagram of runner blade from No. 5 unit showing areas pitted by cavitation after the unit had been in service two years under heavy overloads**

pool level, and the water passes downstream in a series of drops somewhat greater than in the regular fishways.

Not much is known about the success of these miniature downstream fishways, owing to the difficulty of counting the migrants. Studies have been under way for several years, consisting of the release of large number of marked fingerlings just upstream of the powerhouse and dam. A corresponding number are released at the same time in the river below the powerhouse. From the number of fish with the different markings, caught about three years later in the commercial fisheries, it is possible to determine with some degree of accuracy the percentage that successfully pass through the powerhouse and dam and return, compared with the percentage released in the tailrace that return.

Investigations are under way at Bonneville to determine the best method of providing bypasses for downstream passage of fingerlings. Data are required on the relative number passing through the dam, turbines and bypasses, the depth at which they enter the bypasses most readily, and the influence of wind and water temperatures as well as of weather on the movement of the small fish. This information is needed in connection with future dams on the Columbia and elsewhere.

The Bonneville power plant is owned and operated by the Army Engineer Corps, under the direction of the District Engineer, Portland, Oregon District, Colonel Ralph A Tudor.

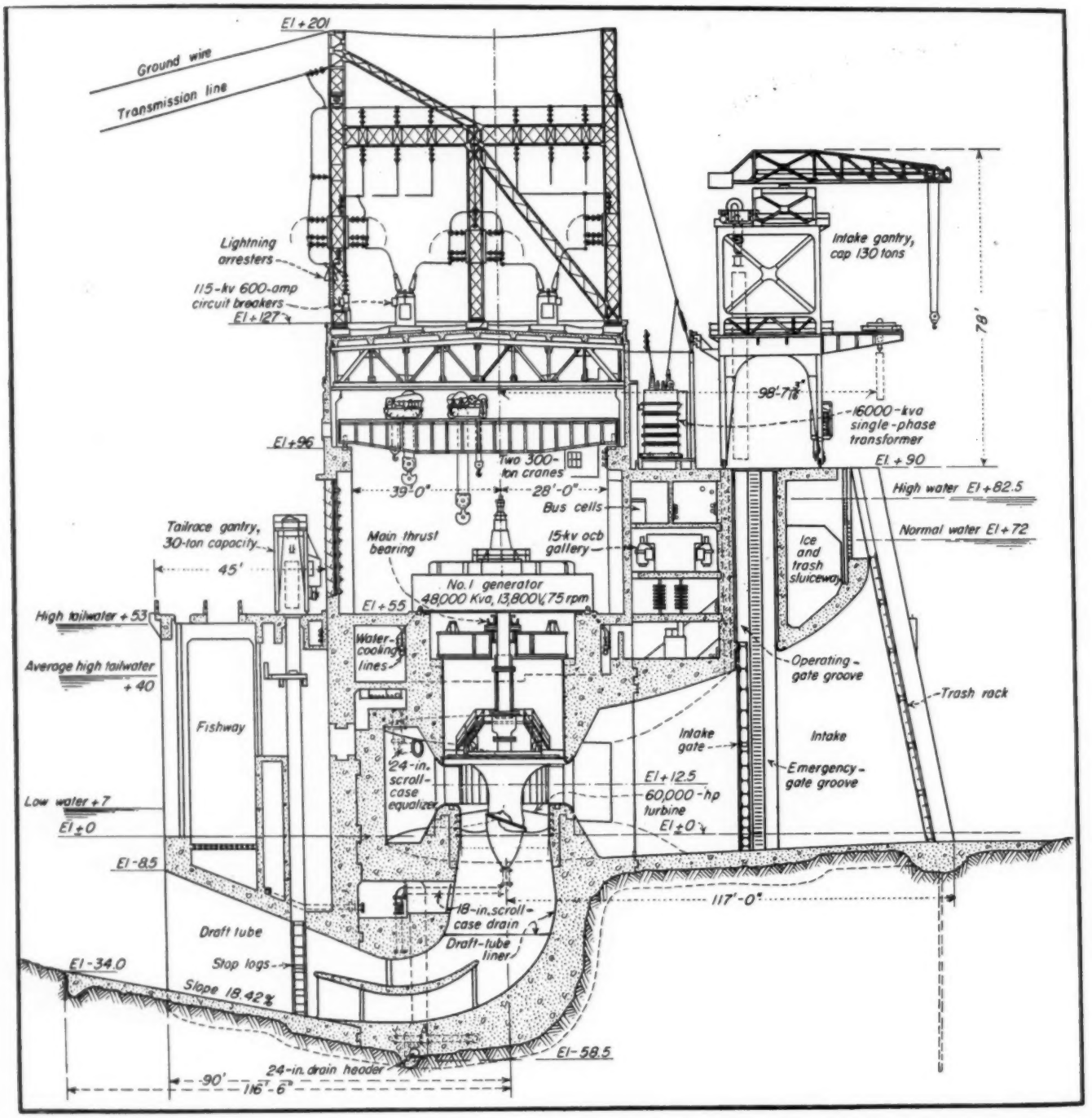



Fig. 4—Traverse section through plant at unit No. 1. The 60,000-hp turbine runner is located 7 ft below minimum tailwater level and 53 feet below high tailwater. Powerhouse design permits the raising of normal headwater level 10.5 ft

# Evaporators Generate Clean Steam From Impure Water for Many Uses

***In central stations evaporators help to obtain pure makeup from brackish water while in industrial applications they produce steam by reclaiming process heat, distill liquids and perform other process functions. Here are the requirements for design, operation and maintenance of this versatile apparatus***

By J B FORBES
*American Locomotive Company*

▶ EVAPORATORS, OR STEAM GENERATORS, produce water vapor reasonably free of contamination regardless of whether the feedwater is fresh, brackish or salt water. Primary distinction between evaporator and steam generator is in the required water-vapor purity produced. Evaporators produce pure water vapor for boiler makeup, distilled water for commercial use or similar service. Steam generators are usually installed where vapor-purity requirements are not so stringent, as for an industrial auxiliary-steam supply. They also serve as a means of reclaiming heat in an industrial cycle.

Mechanical design and thermal engineering are identical for evaporator and steam generator except that in the former the water vapor generated passes through a steam separator. This is situated in the dome section, Fig. 1, and removes practically all traces of moisture and solids. No separators are used in steam generators. Usually the evaporator heating medium is steam, but in a steam generator it often is a stream of hot fluid from some processing cycle from which it is desired to reclaim heat to generate auxiliary steam.

Scale forms on the heating-tube exteriors of an evaporator because of the presence of solids and salts in the feedwater. Normal method of cracking this scale off the tubes is to empty the shell completely of water, pass heating fluid through the tube bundle at full temperature and then "shock" the tubes by either spraying with cold water or flooding the shell quickly with cold water. This shocking of the hot tubes causes the scale to loosen and crack off, falling to the bottom of the shell.

Sometimes the feedwater is chemically treated; this does not eliminate the scale but changes it from hard to sludgy, a type of formation that does not crack off but can be removed by hosing. The three different types of scale are (1) soft sludgy (2) hard that cracks off when shocked (3) another hard that can only be removed manually.

One evaporator design uses a heating element incorporating a means of mechanically deflecting the tubes to aid descaling by cracking. This is known as a flextube descaling arrangement. The heating element consists of a conventional stationary tube bundle supported in a stationary tube sheet at the shell port end and in a floating tube sheet at the other end, Fig. 3. The tubes are installed without deformation, being spaced parallel to the shell length and additionally supported by intermediate tube plates.

These intermediate supporting plates are split on the vertical center lines forming two semisupport plates of identical

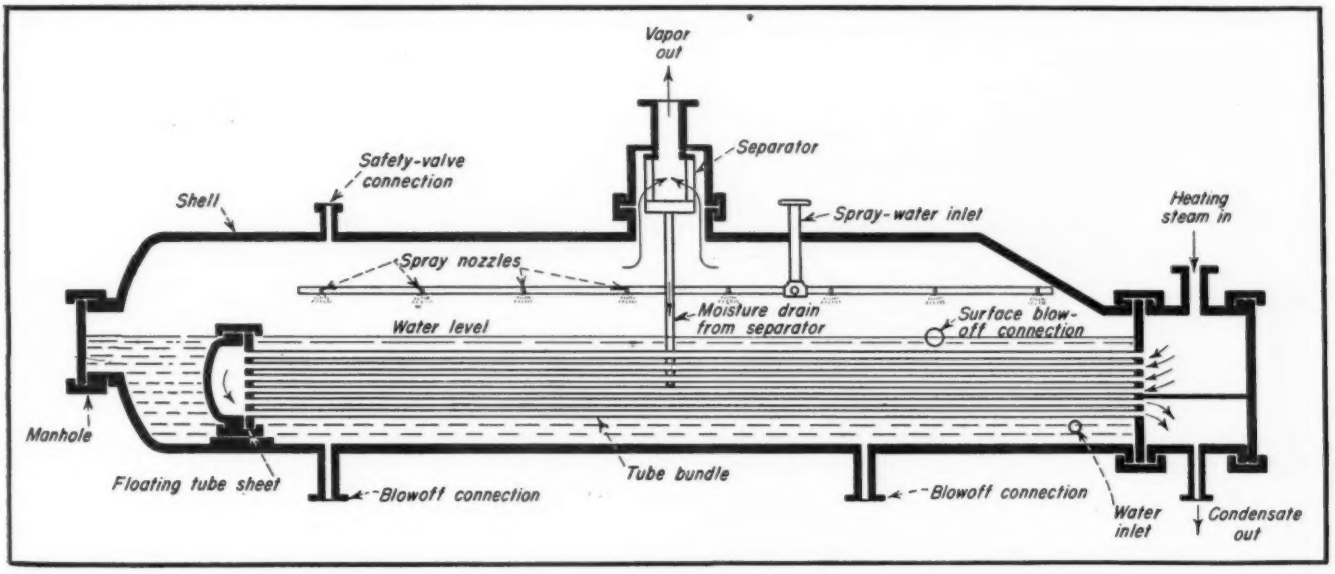



**Fig. 1—Vapor is generated from water in evaporator shell by energy from the heating steam condensing while it flows through the tube bundle. Vapor passes through separator in dome for removal of entrained moisture, which drains back to source. Solids in water deposit as scale on tube exteriors which are washed off by emptying shell and spraying with cold water from spray nozzles while steam keeps tubes hot. Washed-off scale removed by blowoff taps**

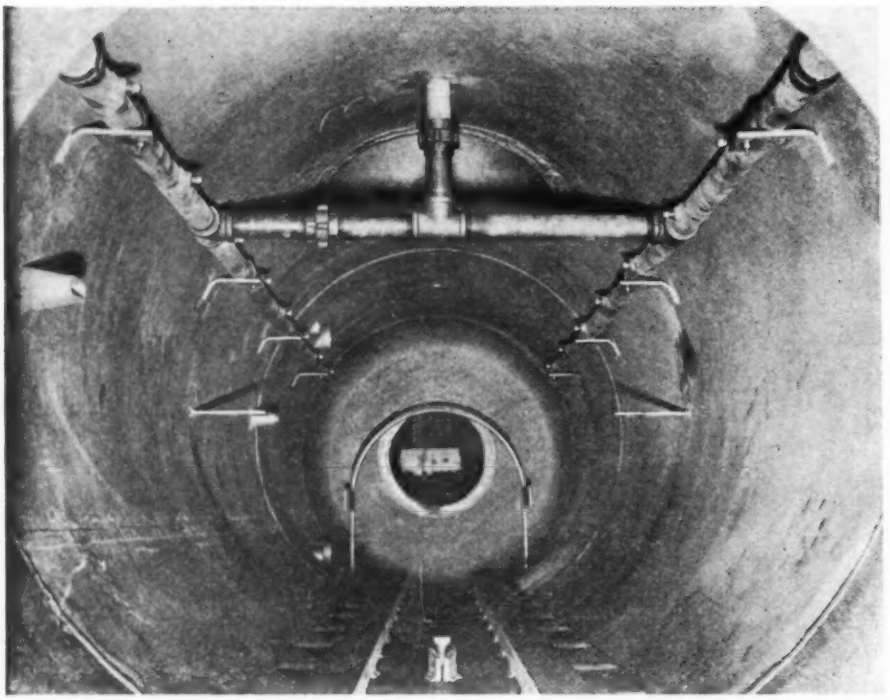


Fig. 2—Evaporator-shell interior with tube bundle removed. Floating-tube head rides on tracks at bottom during tube-bundle removal. Loop at rear centers floating head during operation. Piping at top supplies cold water to spray nozzles used for scale cracking from tube bundle by "cold shocking." Surface blowoff nozzles are at left center of shell; steam-dome entrance above at upper center

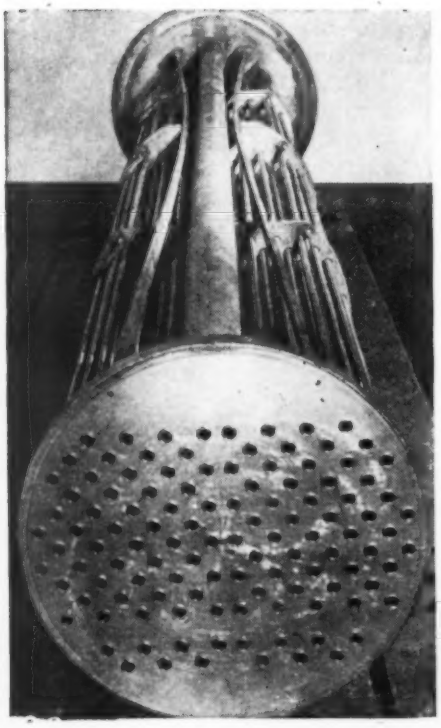


Fig. 3—Cold-tube bundle with curved tension bars in relaxed position, tubes straight and unstressed. Tubular strut and tension bars at top center of tube bundle have mates at bottom. Struts are welded to fixed-tube sheet and ride on pins welded to floating-tube sheet; tension bars fixed to both tube sheets

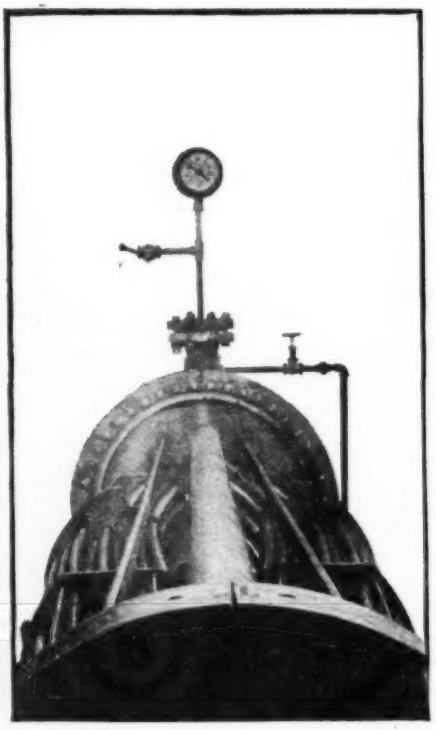


Fig. 4—Heating causes tubes in bundle to expand thus straightening tension bars, which forces split support plates apart, and bows hot tubes. Bending aids hard-scale removal from tube exteriors by cracking in addition to temperature-induced cracking from spraying with cold water while tubes are kept hot

shape located the same distance from the tube sheets. These split plates are fixed longitudinally by means of tierods and spacers. Attached to both the stationary and floating tube sheets are two sets of tension bars, one set at the top of the bundle and the other at the bottom, Fig. 3. At room temperature these tension bars are deflected toward each other at the center longitudinally and separated transversely at the tube sheets.

### *Cracking by Tube Bending*

In the separate support plates are formed recesses or notches against which the deflected tension bars rest. Also fastened to the stationary-tube sheet are two tubular struts located on the vertical center line, one at the top of the element and the other at the bottom. These tubular struts extend the full length of the bundle up to the floating-tube sheet and are in floating contact with it. The struts permit free elongation of the tubes but prevent tube retraction beyond their original length.

Passing hot fluid through the tubes expands them, forcing the floating-tube sheet to move farther away from the stationary-tube sheet. This exerts tension on the bars forcing them to straighten, Fig. 4, which in turn pushes against the notches in the separate support plates. This separates the support plates laterally and deflects the tubes in the horizontal plane. This tube bowing continues as long as heated fluid is applied inside the tubes and varies in amount depending on the difference in temperature between tube wall and surrounding water.

### *Multiple Effects*

In the average installation the evaporator equipment usually consists of a single shell, which is known as a single effect. There are occasions when because of the condensate loss in the system it is advantageous to produce a larger amount of distilled water for makeup than there is initial steam available. This is accomplished by the use of multiple effect, Fig. 5, in which the water vapor produced in the shell of the first effect serves as the heating fluid in the second effect; the water vapor from the second effect can be used as heating fluid in a third effect, and so on, thus producing not only all the makeup from the initial steam condensed from the first effect but also the condensate from the heating elements of the second and third effects, together with the water vapor produced in the third effect.

The major limitation in the number of effects employed in this cycle is dependent upon the relation of thermal head of the initial-steam supply to the first effect

and the shell fluid of the final effect. In round figures, the average single-effect evaporator produces distilled water, which is about 85% of the steam quantity condensed in the heating element. In a 2-effect plant the production of distilled water would approximate 160% of steam quantity condensed in the first effect, and in a 3-effect plant it would be about 225% of the steam condensed in the first effect.

To permit an approximate evaluation of multiple-effect installation cost, the evaporator and equipment for a 2-effect plant would cost about 1.5 times that of a single effect. For a three effect it would be about two times, and for a four effect 2.5 times the cost of a single effect. In making economic studies of this arrangement account should be taken of the increased cost of piping and fittings in addition to the evaporator equipment, all of which must be balanced against the savings in cost resulting from reduced steam consumption.

To insure troublefree operation care should be taken in choosing properly proportioned equipment. One point of mechanical design usually stressed in evaporator selection is the amount of vapor area. This governs water-vapor velocity leaving the shell fluid. It has always been considered essential that this velocity be kept low in order not to carry over large amounts of concentrated liquid to the separator. Actually, the most important feature of an evaporator is the separator itself, for with a properly designed separator it is still practicable to obtain an efficiency better than 99%.

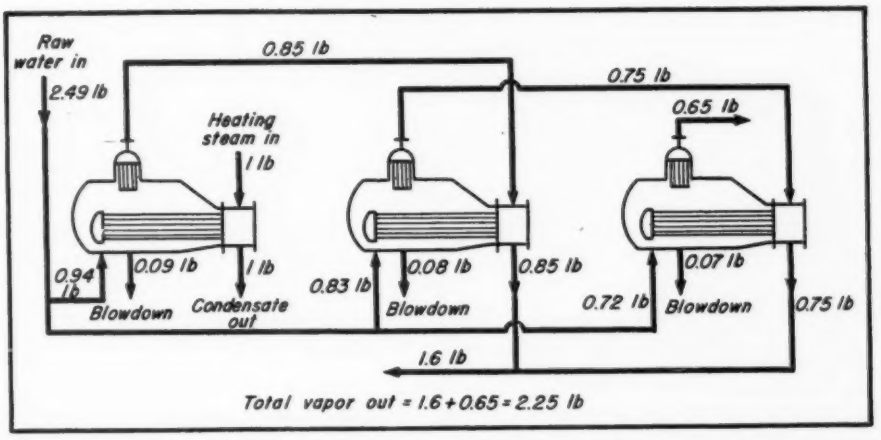



**Fig. 5—Hookup for 3-effect multiple evaporation showing approximate proportion of raw water, vapor, heating steam and blowdown in each evaporator. Each effect increases vapor yield at lower pressure; economics shows how many to use**

Separator efficiency has a direct bearing on the amount of solids that are present in the water vapor. Assume feedwater to the evaporator contains solids of 70 to 100 parts per million and the blowdown cycle of the shell timed to permit a shell concentration of about 1000 parts per million. Any water carried over to the separator contains about 1000 parts per million. If the separator were 99% efficient it would normally produce a water vapor having about 10 parts per million. As it is not uncommon for a separator to have an efficiency of 99.8% the water vapor under these conditions would contain less than two parts per million. Evidently it is necessary to consider more than the mechanical design of the evaporator in approaching the problem of minimum solids in the water vapor, since the shell-fluid percent concentration must be set to produce the desired result in accordance with the known efficiency of the separator.

While in normal practice it is not necessary to remove the heating element of an evaporator more often than at annual or semiannual inspection periods, consideration should be given to the mechanical design to insure low maintenance costs at the time the element is removed, and also to the accessibility of the surface in the heating element after it has been removed from the shell.

# Rapid Detection of Substandard Coals

By R W GAUSMANN
*Director of Research*
*Indianapolis Power & Light Co*

AT INFREQUENT INTERVALS analysis of a coal shipment shows a subnormal figure for ash and moisture-free heating value (H value) usually accompanied by a rather high moisture content. While such coals are usually called "crop coal" it is not certain whether this substandard state is caused by weathering or incomplete coalification from geological circumstances. At best such coals cause a substantial increase in the consumer's fuel bill and at times may affect the load-carrying capacity of the boilers.

A simple test, recently encountered, apparently permits easy and rapid detection of such coals. A few small coal pieces, about the size of a pea, are placed in a beaker, and sufficient concentrated ammonium hydroxide is poured in to cover them. Substandard coal causes a distinct brown color to develop in the ammonia solution while normal coal develops no color except perhaps a turbid gray caused by suspended coal particles. The test appears to be very sensitive since in a washed coal, which normally has a very consistent H value, deficiencies of only 100 Btu per lb in H value cause a distinct brown color.

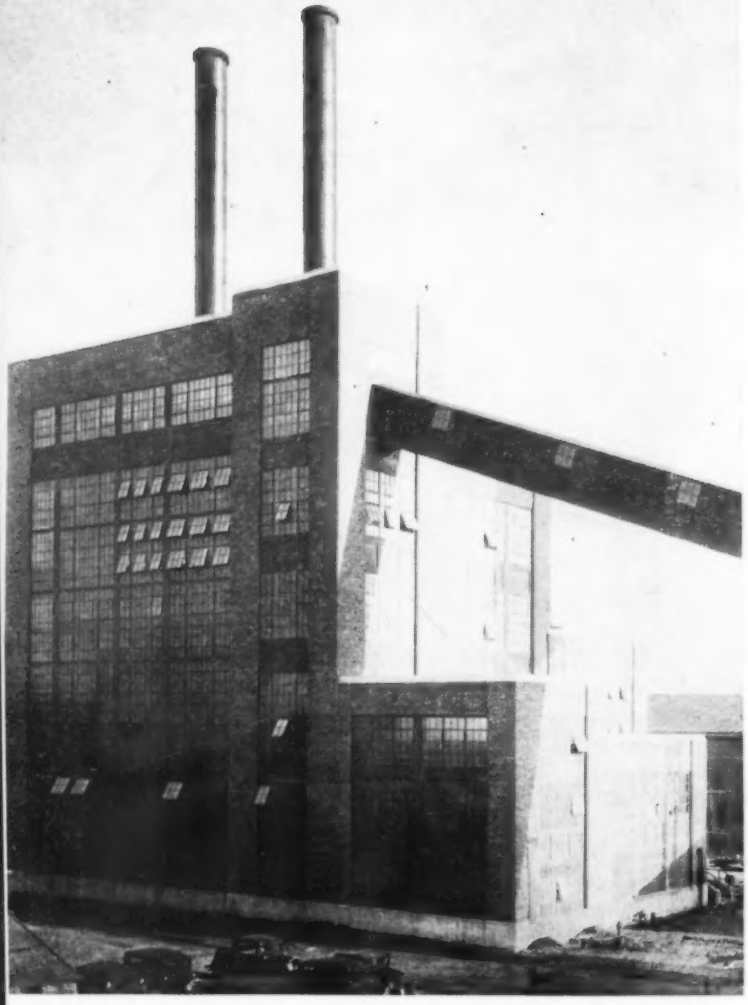
The test as developed in the Indianapolis Power & Light Co laboratory has been used only as a qualitative check. While a quantitative test might be based on this reaction, it seems doubtful whether it would be much simpler than the usual calorimeter determination.

Limited experimentation indicates that this test does not show up the drop in H value usually found in coal that has been stored in the open for several years.

Experience has been limited to a few strip mines in the southern Indiana field. Since theory points to a reaction between the humic acids in the coal and the alkaline ammonia solution as a cause for the brown discoloration, it may be that the test would have general application to other mines and other coal fields.

# Constant Appraisal Promotes Active Plant Betterment

***In periodic studies of practice and equipment Forstmann Woolen Co seeks employe participation, knowing that improvements are more likely to flourish and prove lasting in a receptive organization. This sketch outlines the mechanics of bettering plant operation***



Garfield power plant of Forstmann Woolen Co. Modernization to extend capacity is under way, with construction of another steam generator ordered

▶ SOME 15 YEARS AGO Forstmann Woolen Co replaced two old boiler plants, at their Passaic, N. J., finishing mill, with a single new plant housing more efficient steam-generating units and employing more progressive methods. This modernization program at the start of a generally depressed business cycle resulted from conclusions based on independent engineering and economic analyses. The recommendations now under study, leading to another change in plant equipment and practice, appear likely to meet with approval. Thus constant self-appraisal promotes a continuously progressive policy.

Present power facilities at Passaic consist of three bent-tube boilers, 60,000 lb per hr capacity, at design pressure of 250 psi and 100-deg superheat. A flue gas-scrubbing system on boiler outlets removes extraneous gas-borne substances in a sufficiently thorough fashion so smoke and its allied difficulties present no problem. Discharge water from these scrubbers passes through filters to remove dirt, dust and other objectionable foreign matter before final disposal.

These boilers supply steam for (1) power generation to turbines (2) driving energy for auxiliary turbines (3) process steam for mill use. Two lines, metered at the powerhouse, distribute this steam throughout the mill. A third line serves as a header for 25-psi steam, receiving exhaust at this pressure from all auxiliary drives as well as extraction steam from the main power turbine.

Turbine-generator equipment comprises a 1250-kw extraction unit, one 750- and one 300-kw straight-condensing turbine. Each turbine operates at 250-psi throttle pressure except the 750-kw unit, which receives 150-psi steam from a reducing valve, and acts as standby.

Under normal operation, plant load calls for only the 1250-kw turbine with holiday and spare-load service supplied by the 300-kw unit. With this 1250-kw automatic constant-pressure-extraction machine on the line, the extraction steam always leaves at 25 psi. A grid valve, which cuts down the quantity of steam passing through the last stages of the turbine and entering the condenser, regulates amounts of extraction flow to maintain a constant 25-psi pressure at that point. At all times, however, at least 1800 lb per hr of steam must enter the condenser to prevent overheating. During periods of maximum extraction, operation of this machine approaches that of a backpressure turbine running with speed governing. As extraction-steam demand drops off in proportion to the electrical load, more and more steam passes through to the condenser until, at the point where no steam is extracted, machine operation parallels that of a straight-condensing turbine.

Since extracted steam serves mill purposes as well as steam from a reducing valve, plant economy favors extraction because power generated by the steam in passing from throttle to point of extraction is obtained at slight direct cost. In addition to all fixed charges on this steam those direct ones measured in coal per kwhr permit this approximation. Heat given up by steam undergoing extraction amounts to the difference between 1261 Btu per lb at the throttle and from 1165 to 1200 Btu per lb at the extraction stage, a figure equivalent to less than 1/100 lb of coal per kwhr.

### *Steam for Auxiliaries*

For economy reasons again, auxiliary drive comes from mechanical turbines with exhaust recovered for mill use. Should this low-pressure exhaust steam, after supplying heating for both powerhouse and feedwater, prove insufficient for mill purposes, makeup steam from 250-psi lines through reducing valves in the mill would meet this condition.

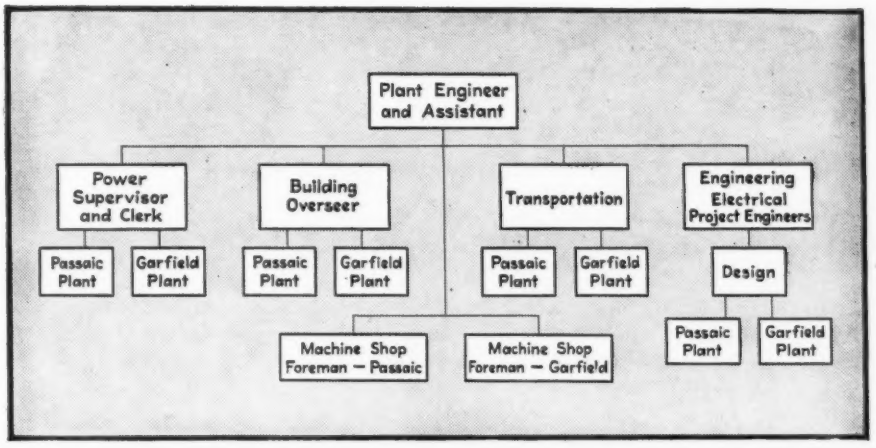
In the Passaic, or finishing, mill demands for process steam exceed those for

power generation so some operating system as well as some performance gage becomes imperative. In setting up this system a growing industrial thought for betterment prompted an organization elastic enough to embrace such activity.

Process needs occur throughout the mill yet it is not feasible to extend the direct responsibilities of power-plant personnel beyond their immediate charges. For this reason under the plant engineer this line of organization exists: (1) general engineering, covering design and execution of new projects and changes in present facilities (2) mechanical, electrical and building maintenance and (3) generation and distribution of steam and power.

Under generation and distribution of steam and power headed by a power supervisor come shift foremen, chief power clerk and water-treatment chemist.

Responsibility for betterment within the power plant rests largely upon this chief power clerk, who is a technical man. He it is who with one or more clerks daily collects and tabulates operating data for information and approval of the power supervisor. The power clerk scrutinizes all recorder charts, log sheets and operators' reports, and institutes checks on operation of controls, personnel alertness, over-all efficiency. He presents reports that serve as a coordination basis between power plant and general mill. Minor recommendations from discussions between power-plant supervisor and clerk receive immediate attention. Larger changes are subjected to round-table study by these two and the plant engineer.

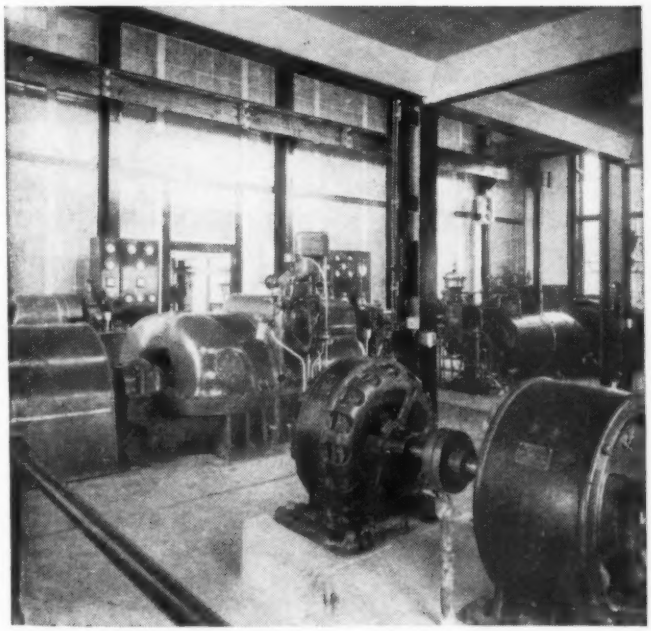


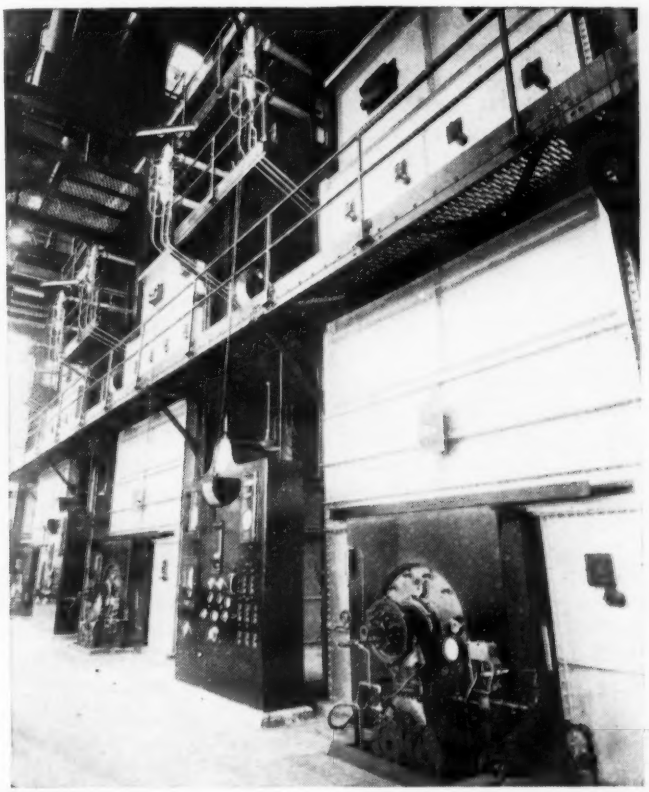

**Organization chart demonstrates flow of authority within scope of the betterment program. Project engineer and power supervisor form a part of management**

To affix responsibility fully for constant maintenance of operating procedure and control equipment this power-plant clerk assumes charge of calibration and periodic checks of such devices. Charts and records of this nature include (1) daily log sheets of hourly readings on indicating gages and control settings (2) daily log books of operating peculiarities, breakdowns and comments of operators (3) daily recorder charts from pressure, temperature, $CO_2$ and flowmeters (4) daily reports on generation, distribution, fuel and efficiency.

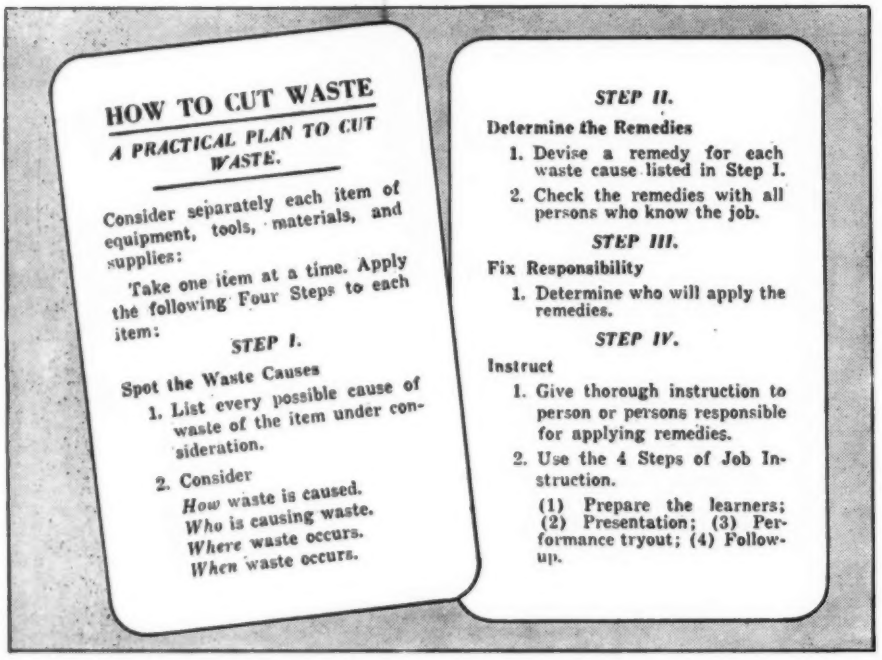
Serving as a guide for standard practice or as a basis of comparison a manual, called *Heat Balance and Station Performance*, helps to formulate intelligent judgment in these matters. Moreover, this twofold manual aids in training operators. Design data and guarantees substantiated by acceptance tests form a framework for establishing performance checks.

Water-treatment tests, readings of oxygen content in boiler feedwater, steam quality and boiler blowdown lie within the chemist's duties. Quality of process water to the mill likewise falls under





**Above: View of turbine-room layout at Passaic mill. Glass partition at the rear divides boiler room from turbine section and furthers the impression of orderly cleanliness. Right: Front view of three pulverized-coal-fired steam generators. The water column and individual boiler controls appear in prominent fashion to the left of all the boilers**



**HOW TO CUT WASTE**

*A PRACTICAL PLAN TO CUT WASTE.*

Consider separately each item of equipment, tools, materials, and supplies:

Take one item at a time. Apply the following Four Steps to each item:

*STEP I.*

**Spot the Waste Causes**

1. List every possible cause of waste of the item under consideration.
2. Consider
   *How* waste is caused.
   *Who* is causing waste.
   *Where* waste occurs.
   *When* waste occurs.

*STEP II.*

**Determine the Remedies**

1. Devise a remedy for each waste cause listed in Step I.
2. Check the remedies with all persons who know the job.

*STEP III.*

**Fix Responsibility**

1. Determine who will apply the remedies.

*STEP IV.*

**Instruct**

1. Give thorough instruction to person or persons responsible for applying remedies.
2. Use the 4 Steps of Job Instruction.
   (1) Prepare the learners; (2) Presentation; (3) Performance tryout; (4) Follow-up.

**Two sides of foreman's pocket-sized card, "How to Cut Waste." Printed matter illustrates sharp to-the-point delivery of message that is considered so necessary**

his responsibility for treatment, tests.

Betterment studies outside the power plant ordinarily originate with project engineers in the mill who report to the plant engineer. Instances develop, however, where checks of power-plant operation indicate operating procedures within the mill itself that reflect in excessive or uneconomical power or steam demands. One case arising from dye-house operation appeared as a widely fluctuating load on the boilers. Normal procedure favored full-blast starting of all dye tubs with an added operator's quirk of spinning his steam valve wide open. This heavy load combination disappeared through cooperation and understanding of final dye-house use. A schedule, extending starting times over 20-minute periods coupled with proper and repeated instructions to operators, shows immediate, lasting benefits in an ironed-out steam-flow curve free of serious valleys.

Through a monthly meeting of plant engineer and his aids, the power supervisor and his power-plant clerk exchange ideas on suggested betterments. One such proposal involved company policy covering mill shutdown periods for lunch and shift changes. During times of light load this practice offered no serious problems but with a return of normal times and loads, all such sudden stoppages produced a terrific effect on boilers on the line. A graphic presentation of this difficulty to those concerned resulted in its solution by staggering lunch periods of various departments.

One regular feature of these monthly meetings, an up-to-date check chart, shows all uses of high- and low-pressure steam to production equipment. This regular appraisal of plant loading keeps pace with changing operation so that steps in procedure or scheduling can be readily arranged as conditions develop.

Within the mill proper project engineers, as previously mentioned, handle basic detailed betterment studies. Their position in manufacturing areas places them near enough to operations both to inspect at first hand and to confer with the master mechanic and maintenance personnel. When a trouble spot develops, the project engineer secures operating and test data. Past experiences show that cooperation of mill operator and foreman is this engineer's strongest tool. Remedies for most mill difficulties lie in either a revision of operating procedure or a moderate equipment change such as a change in pressure of steam admitted to the operation.

Projects of a more sweeping nature depend heavily on the tool of cooperation so that any human reluctance to change is at a minimum. To assure genuine cooperation and not mere lip service, success or failure of projects rests with the engineer instituting them. Experience indicates that savings brought about by a project forced upon operators without winning their cooperation would not endure because of the abnormal policing required.

For a project of such scope a written report signed by plant engineer and the particular department's superintendent crystallizes the project, reduces misunderstandings and promotes cooperation.

Efforts to extend betterment ideas as close to the job as possible fostered adoption of a vest-pocket "How to Cut Waste" card for all foremen. This card, as shown, instructs in steps to (1) spot waste causes (2) determine remedies (3) fix responsibility (4) instruct. While such steps advance no new principles they do accent a need for on-the-job participation by plant personnel.

### *Job-Understanding Valuable*

A thorough understanding of process and product gives a foresight that prevents any "penny-wise, pound-foolish" economies. Apparent economies from use of superheated steam in process prove most costly if wool suffers injury. Similarly an obvious saving from shutting off steam supply to big cylinder presses between operations would return to exact a heavy toll in imperfections in finished product and a warping of the cast-iron cylinders from too frequent heating and cooling under such a change.

An awareness, however, of steam costs enables a "waste chaser" to institute many money-saving adaptations. Dyeing operations, which formerly used 100-psi steam, function better with a change in equipment designed for a lower-pressure steam extracted from the turbine. In addition to steam savings, further studies along this line are justified by less wear and tear on control valves that now operate in full open position, as well as absence of dye difficulties under former rapid-temperature changes in dye liquor.

One large saving in electrical loading, that of a serious low-power factor condition on looms, came about through a report to a project engineer from the power clerk. A recommended replacement of obsolete static condensers produced a desired reduction in power consumption.

Constant effort focuses on extending this alert job-betterment interest to all personnel. Some of this cooperative spirit may result from a sense of mutual gain aided by such programs as the Carl Forstmann Foundation. Funds from this source provide in addition to the more generally known college-scholarship aids an employe-education program. Courses covering a diversity of interests from cooking to power-plant practice and engineering economics have been made available to employes and their relatives. This attempt at constant betterment of personnel and plant practices can reflect only in the most favorable manner.

# Coal-Fired Gas-Turbine Prospects Bright

▶ AT A MEETING of the ASME metropolitan-section fuels division on Feb 5, 1946, John I Yellott, director of research, locomotive development committee, reviewed the committee projects aimed at developing a coal-burning gas turbine for locomotive drive (POWER, Aug 1945, pp 73-75; Mid-Dec 1945, p 96).

Preliminary results of tests carried out by the cooperating research institutions encourage the belief in ultimate success of the venture. Major problems center about (1) coal requirements (2) bunker arrangements (3) drying provisions (4) crushing needs (5) conveying and pressurizing (6) pulverizer power (7) flyash removal and disposal. For a 2000-hp unit, illustrated below, which delivers 1600 hp at the rails with electrical transmission, coal input will average about one ton per hour at full load.

### *Two Turbines Per Locomotive*

Space availability will make it possible to mount two 2000-hp gas-turbine units side by side in the same locomotive with the coal bunker at one end. For a coal bunker with a center corridor there will be sufficient fuel to run both units for almost 12 hr at full load.

Coal with as much as 15% moisture will have to be handled. Estimates indicate that 3% of the turbine exhaust would suffice for drying and could be piped through an 8-in. round duct.

The coal-jet pulverizer requires protection against tramp iron and oversized coal pieces, which would cause clogging. Maximum size to the pulverizer will be limited to 8 mesh for satisfactory operation. Crushing and drying may be carried out in a common unit at the screw-feeder discharge from the bunker bottom, as shown in isometric sketch below.

Pressurizing the coal prior to pulverization will probably be done by lock hoppers or twin tanks. Crushed coal would be conveyed pneumatically from the crusher to a receiving tank where the transporting air would be discharged to atmosphere through a battery of Aerotec tubes. These are small cyclone-type separators having high efficiency. From the receiving tank the coal would be admitted to the twin tank not in operation. When filled the tank is closed and raised to operating pressure; it is then ready to discharge its coal to the jet pulverizer as soon as the other twin tank empties of its coal charge.

For its operation the jet pulverizer requires air at a pressure 60 psi above that of the combustor. This is obtained from an auxiliary compressor taking its suction from the discharge of the main compressor and also driven by the main gas turbine. When the air is cooled between the two compressions the auxiliary compressor requires slightly more than 1% of the shaft power output of the unit.

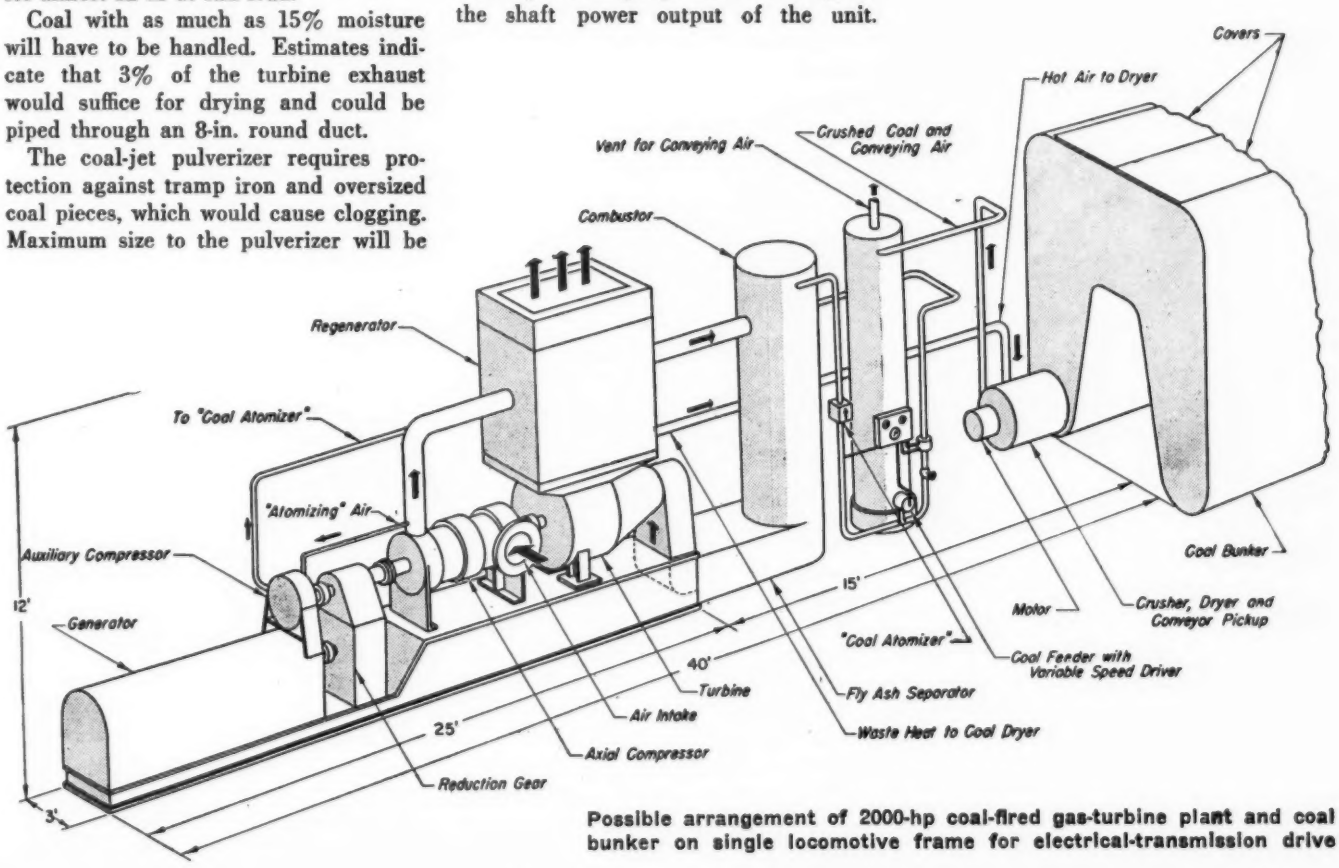
Total auxiliary power needs for bunker feeder, crusher, pneumatic conveyor, jet-pulverizer and pressure tank feeder will add to slightly more than 2% of shaft output.

Perhaps the most important problem is flyash control. A promising solution uses Aerotec tubes, which remove all particles greater than 5 microns diameter from the gas leaving the combustor. Investigation has indicated that particles of this size and smaller pass through the turbine with the gas stream without any or only negligible abrasion of the blading. Getting rid of flyash raises a serious problem, but it may be useful for sanding the rails.

An alternate scheme of introducing crushed coal into the pressure tank forces it in through a screw conveyor. The highest tank pressure in which this method has proved workable to date is about 65 psig. Further experimentation is being carried on.

H D Emmert, Allis-Chalmers Mfg Co, announced that since 1942 his company has sponsored an extensive research program at the Battelle Memorial Institute

(*Continued on page* 202)




**Possible arrangement of 2000-hp coal-fired gas-turbine plant and coal bunker on single locomotive frame for electrical-transmission drive**

# Can Exhaust Turbines Rejuvenate Liberty Ships for Postwar Trade?

***Turbines using reciprocating-engine exhaust steam, often applied on land, can also be used in marine plants to increase power and fuel economy. Brown Boveri design solves problem of coupling engine and turbine to a common propeller shaft***

By S A TUCKER
*McGraw-Hill World News*

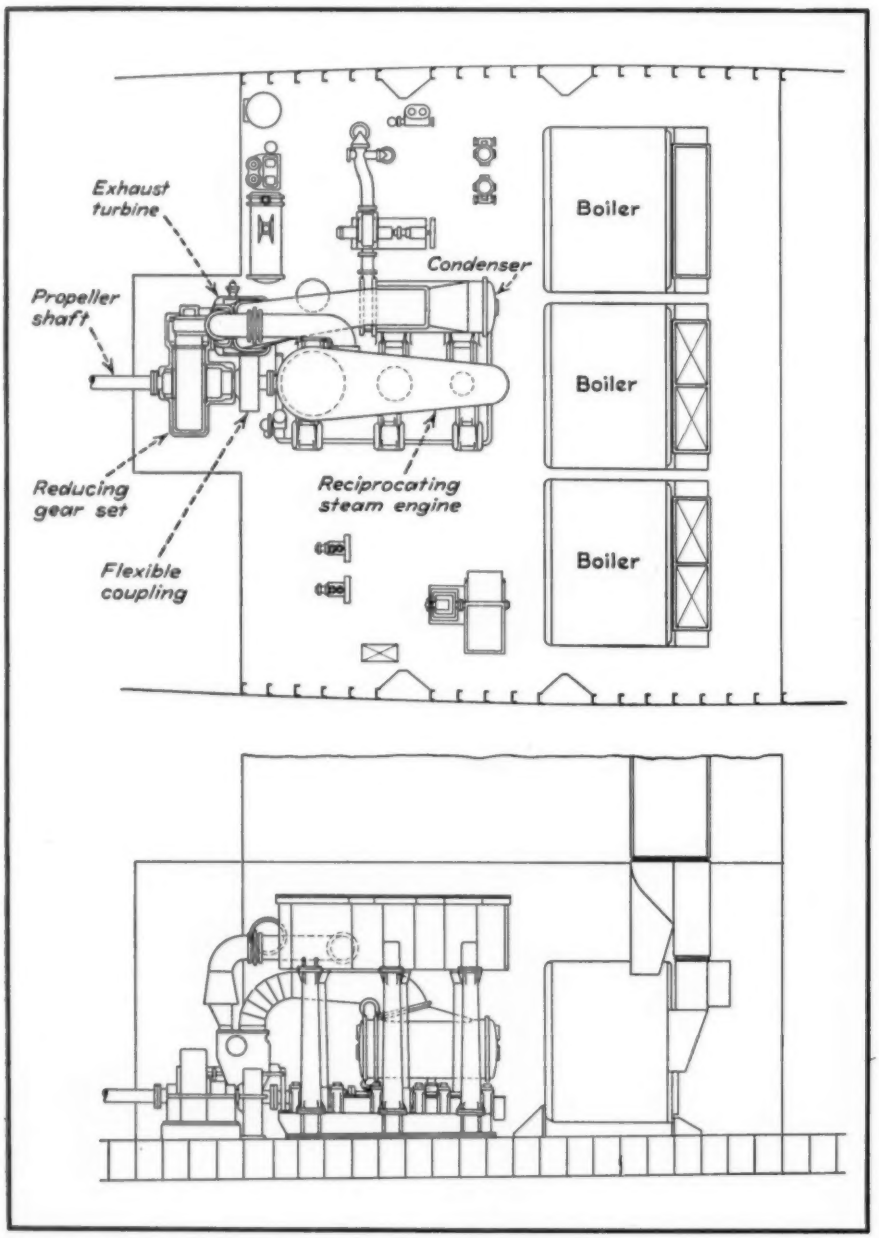



**Fig. 1—Plan and elevation views of marine plant showing relative sizes of engine, exhaust turbine, reducing gear set, flexible coupling and auxiliaries. Space needed by added machinery developing about 20% extra capacity is not very large**

▶ To meet World War II's tremendous shipping demands, and to utilize to the full the United States' varied manufacturing facilities, cargo ships powered by reciprocating engines were mass-produced. These now famous Liberty ships served their purpose in wartime when fuel economy was a minor consideration, but for postwar commercial operations they suffer from high fuel consumption.

Installing a turbine coupled to the propeller shaft and supplied by exhaust steam from the engine offers the possibility of developing additional power for the same fuel consumption, thereby increasing both capacity and efficiency and making these ships more suitable for the war-depleted merchant marines of many nations.

Exhaust-turbine installations were developed as early as 1930 by some of the European manufacturers. There have been several applications on marine plants of 2800 to 4700-hp total combined capacity with results evidently good. The turbine develops about 20% of the total capacity. Fig. 1 shows the general plant arrangement, and the small additional space required by the turbine, reduction-gear set and flexible coupling is evident.

### *Turbine Features*

A flexible coupling connects the gear-wheel and engine shafts. Turbine aids in driving the propeller through the 2-step reducing-gear set. Engine, turbine and propeller shaft remain coupled during maneuvering and astern running. A rotary valve between turbine inlet and exhaust permits bypassing the turbine during reversing operation by leading exhaust directly to condenser.

Fig. 2 and 5 show assembled and disassembled views of a turbine and reducing-gear set designed in 1931. Weights of these units, which originally were about 57 to 60 tons, have been reduced by about 25% by improved design.

Difference in the character of the shaft torques developed by the reciprocating engine and turbine presents difficulties in coupling the two prime movers to a common propeller. While turbine torque inherently remains constant, engine torque may vary by as much as 60% during one shaft revolution. For this duty couplings of hydraulic, friction and spring designs have been used.

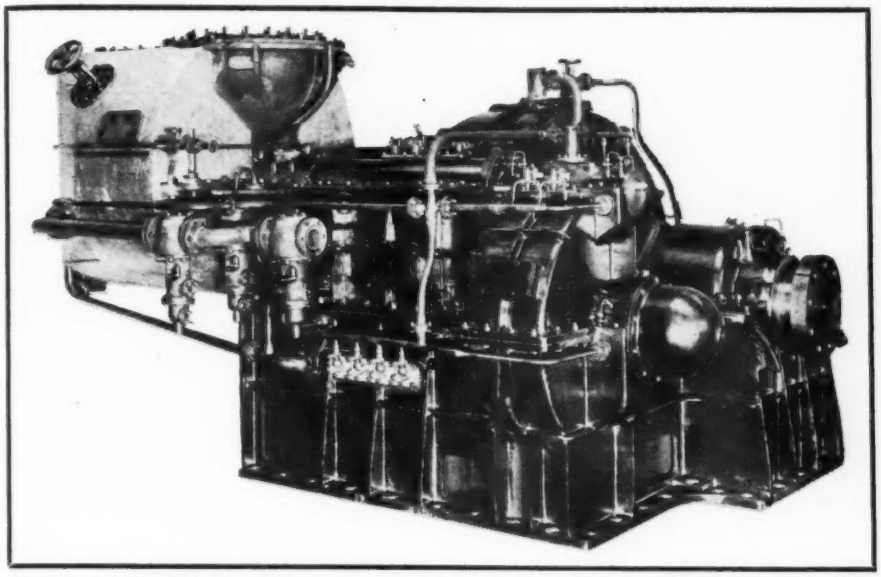


Fig. 2—Exhaust-steam turbine and reducing-gear set for marine plant. Turbine casing at upper left corner and propeller-shaft coupling flange at extreme right. Turbine develops about 1300 hp at 3400 rpm with inlet steam pressure of 5.7 psia and vacuum of 28.5 in. Hg at exhaust. Gears bring propeller speed down to 86 rpm

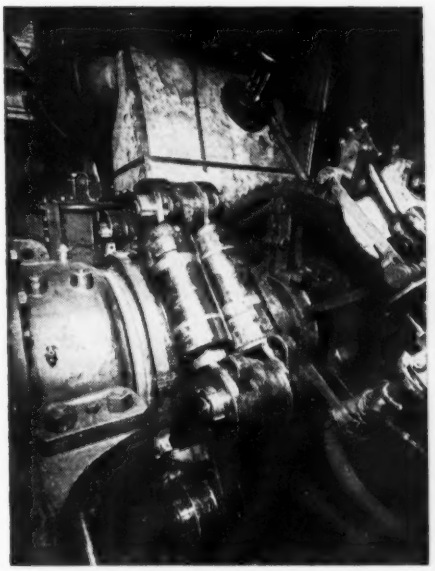


Fig. 3—Shipboard view of flexible coupling with casing removed. Center: ring springs connected in parallel. Upper center: turbine casing, control valve

Hydraulic couplings have relatively high energy losses and require couplings for each direction of rotation. To avoid providing extra couplings for reverse operation the turbine is disconnected by draining the fluid from the coupling during this operation. Refilling is required before the turbine can be replaced in service for normal operation.

Friction couplings require high pressures to transmit the large torque needed at the propeller. This entails the use of either special compressing devices or very large coupling dimensions.

Spring couplings of ordinary design are liable to set up vibrations which in the case of resonance can lead to dangerous stresses. This results in the need for supplying special damping devices to prevent resonant vibrations.

To get around these disadvantages a special form of friction spring has been developed for use in the flexible coupling as shown in Fig. 3, 6 and 7. The spring consists of individual ring elements arranged as in Fig. 6 and 7. When this ring spring is compressed and then released the energy recovered is about one third of that for compression; the remaining two thirds has been dissipated in friction between the ring elements.

In contrast to coil springs which deflect as the load varies, the ring spring will not change deflection for large changes in load. Fig. 4 shows that, as the spring is loaded from relaxed condition, up to *a* it deflects uniformly with load. If load is removed from *a* to *b* the deflection is unaltered; for further load reduction below *b*, the deflection will uniformly decrease towards zero. If load is reduced to only *c* and then again increased the deflection remains constant until the load exceeds *d*, after which the deflection again in-

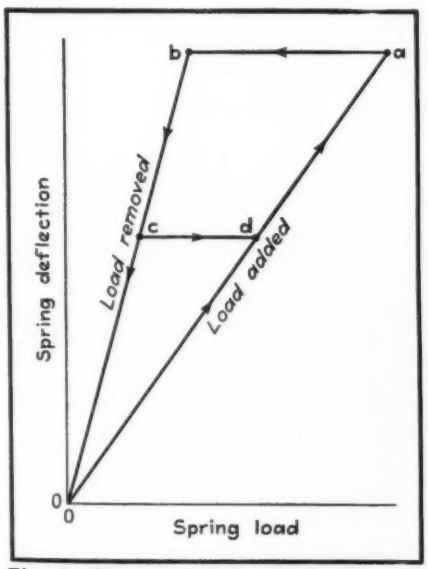



Fig. 4—Ring spring load-deflection diagram showing large load changes possible with no change in spring deflection

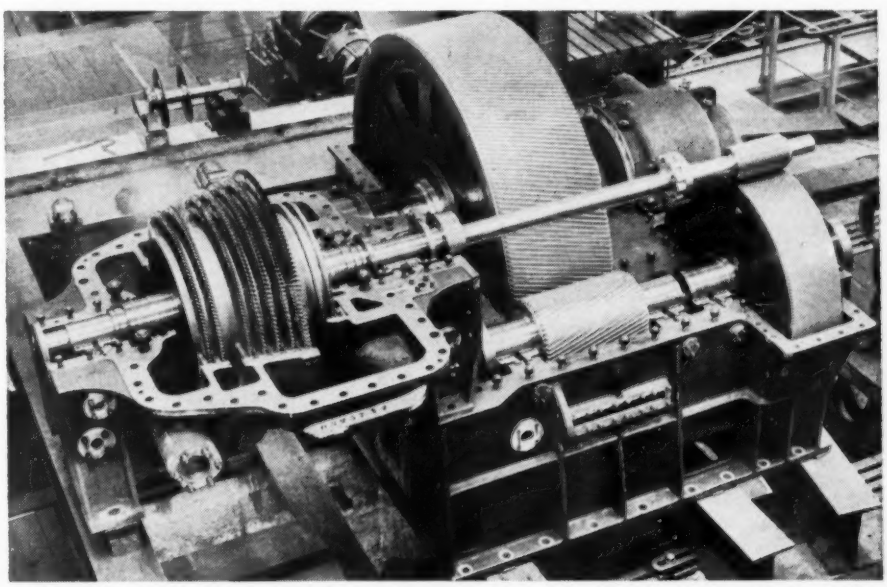


Fig. 5—Exhaust-steam turbine and gear set of Fig. 2 with top half of casing removed. Flexible coupling for connection to engine shaft hidden behind turbine

creases with load up to the point *a*.

Fig. 7 shows the coupling to consist of three fingers (*a* and *b*) on each of the gear and engine shafts connected together by pairs by ring springs. The large section shows the ring spring in relaxed position, the smaller sections show the spring positions for ahead and astern operations. Grease fills the interior of the spring casing. Any spring can be easily removed for replacement or repair by loosening a few nuts.

With this type coupling the relatively large changes in engine-shaft torque are not big enough to exceed the limits which will change the spring deflection, so for normal operation the turbine, engine and propeller are rigidly coupled. Mass of the turbine and gear set has a flywheel effect so that variation in propeller torque is reduced compared to engine drive alone. This results in more nearly constant speed and smoother operation.

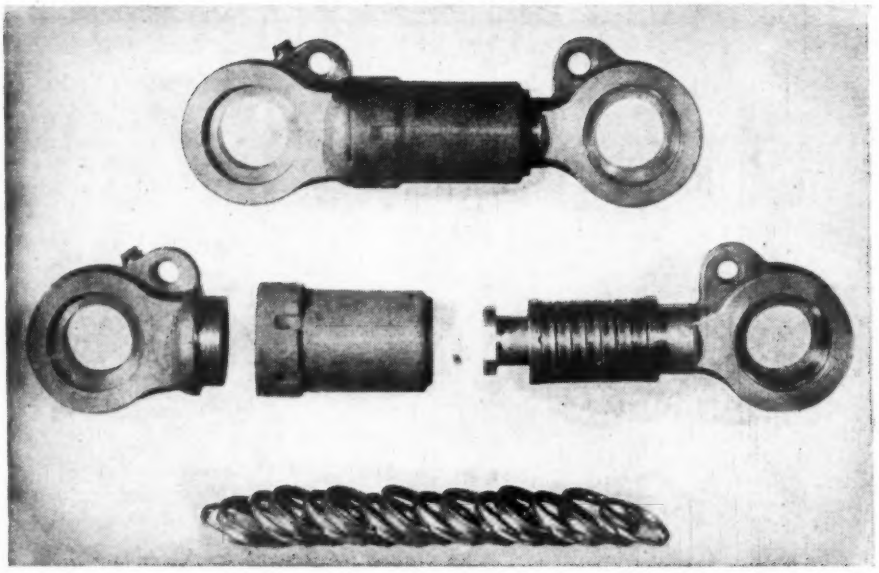


**Fig. 6—One ring-spring element of flexible coupling, assembled and disassembled, showing major component parts and individual rings making up the friction spring**

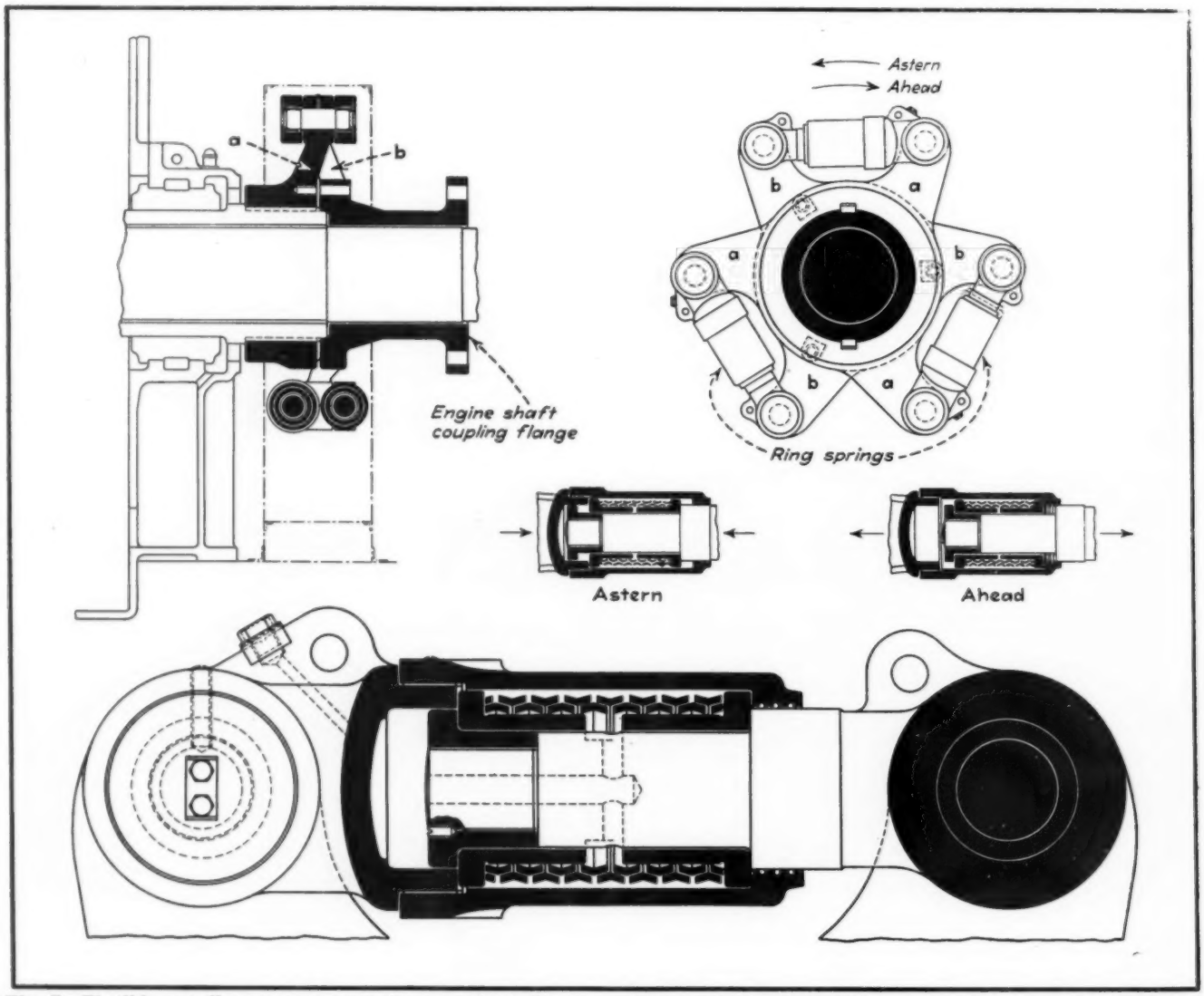



**Fig. 7—Flexible coupling arrangement shows method of connecting ring-springs between engine and large-gear shafts. Lower view: cross-section of spring assembly in relaxed position; auxiliary views: compressed operating positions**

# Motor-Driven Automatic Timer Matches Generator Voltage With Process Cycle

***A R Wismer and his engineer associates in a Canadian plant's maintenance dept had to supply dc power to a process requiring a complicated voltage cycle so they built an accurate automatic timer that frees the operator for other jobs. Equipment can also be used for various voltage-control problems***

▶ OUR PLANT SUPPLIES POWER to anodizing processes that put a protective coating on aluminum alloy used in aircraft construction. Parts to be treated are immersed in a tank of 5% chromic acid held at a temperature of 98 F, plus or minus 1 deg. In the acid they are connected to the positive side of a dc power source, and the tank to the minus side. Power is supplied from an ac-motor-driven 150-kw dc generator under field-rheostat control to provide the desired voltage.

Any one of several operation cycles can be used to control the current to the process. On one, the BAC No. 2 cycle, voltage at the beginning is increased from 0 to 40 v in 10 min, held at 40 v for 5 min, then raised to 50 v in 3 min. and held at 50 v for 2 min to complete the cycle. Total time is 20 min.

If voltage for these processes is controlled manually, an operator is needed continuously at the generator's control board to adjust the field rheostat. Having decided this job could be done better automatically we developed controls that have served our purpose well. No doubt they can be used in other applications for dc-voltage cycles.

For the 20-min process there are two separate control units. One is a solenoid-operated rheostat, Fig. 1, in a cabinet behind the switchboard and a timer unit, Fig. 2, on its front. Both automatic and manual voltage control are provided in the field rheostat, as indicated at the left, Fig. 3. For automatic control, double-throw switch *S* is closed to its down-position.

With both field-rheostat arms turned all the way to the right, the generator-field circuit is from the + side of the exciter, through the generator-field winding, the manual-rheostat arm, the left-hand side of switch *S*, back to the exciter. The automatic rheostat is connected in parallel with the generator-field winding by a circuit from the exciter through the automatic rheostat, right- and left-hand sides of switch *S*, back to the exciter.

Placing the rheostat arm in full right-hand position gives maximum generator voltage. When the arm is turned to full left-hand position the circuit is through the rheostat, the right-hand side of switch *S*, and directly back to the exciter. In this rheostat-arm position the right-hand side of switch *S* short-circuits the field winding to give zero generator volts. Thus by turning the field rheostat from full-left to full-right position, generator voltage can be regulated from zero to full value, or vice versa.

In the same way the manual rheostat controls the voltage when double-throw switch *S* is in its up-position. Double-throw switch *S* is locked in closed position with two bolts so that it cannot be opened accidentally. To further protect the field circuit from accidental opening, the rheostats are so connected that even if switch *S* were opened the circuit would be complete.

For instance if switch *S* were open in Fig. 3, a circuit would be complete from + on the exciter through part of the automatic rheostat, the field winding,

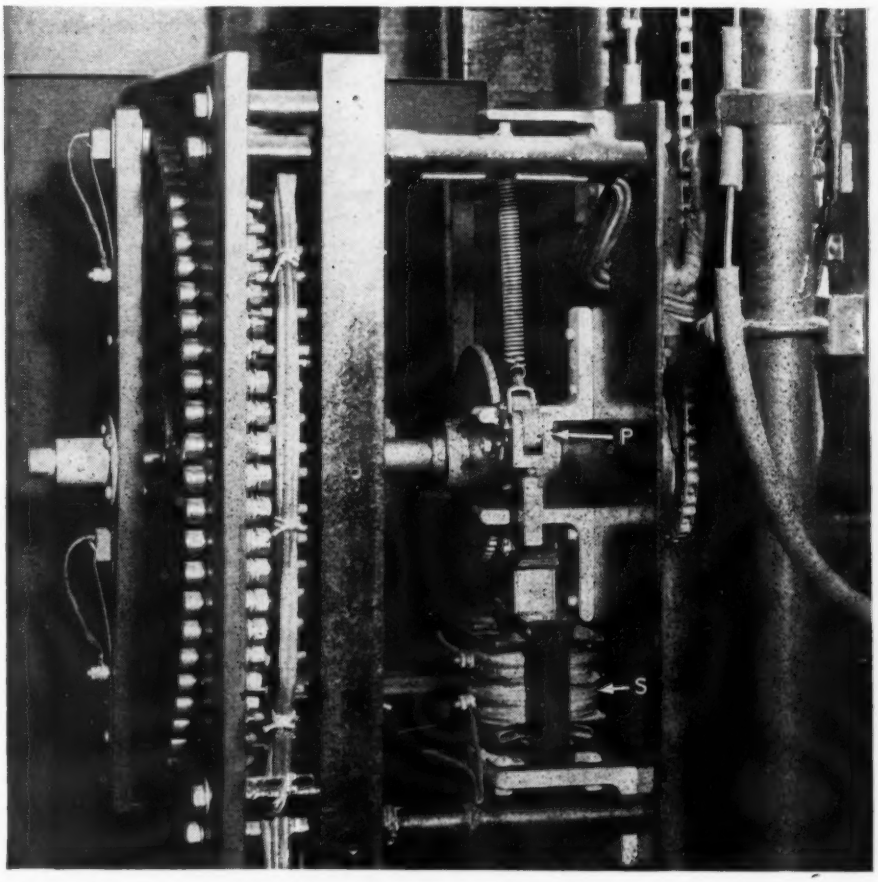



**Fig. 1—Solenoid-actuated field rheostat for 150-kw process dc generator gradually increases the voltage from 0 to 40, then to 50, according to a fixed time cycle**

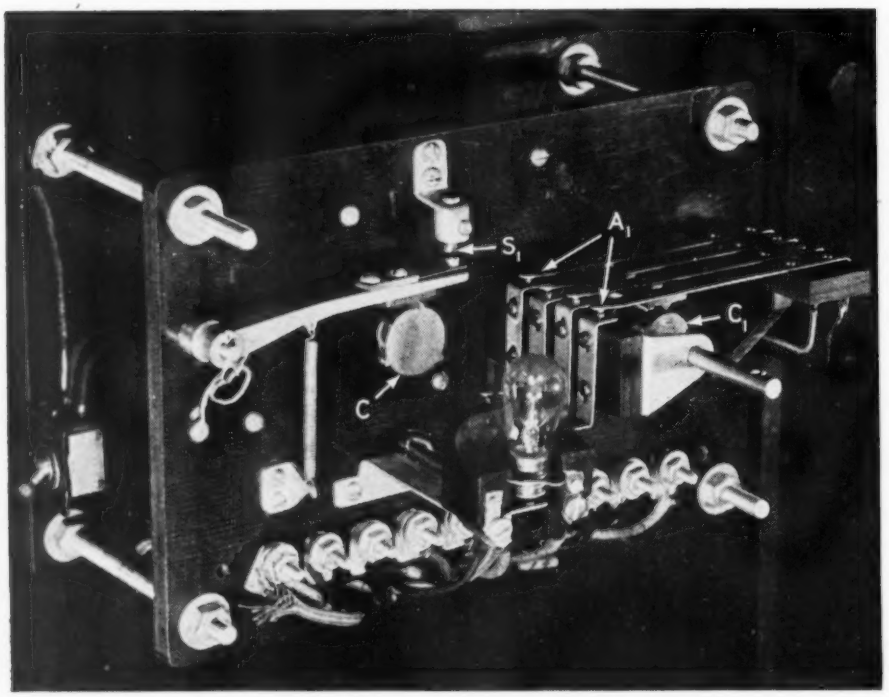



Fig. 2—Timer for 150-kw generator voltage-cycle controller shows timing cams $C_1$ and contacts $A_1$; field-rheostat-actuating solenoid cam and contacts at C and $S_1$

part of the manual rheostat, back to the exciter. This circuit always maintains at least part voltage on the generator.

On the rheostat the arm is notched around by a pawl and ratchet $P$ driven by the ac solenoid $S$, Fig. 1. The pawl engages the ratchet wheel only when the solenoid is energized; otherwise, the rheostat arm is free for manual operation with the handwheel. Each rheostat contact has a corresponding notch on the ratchet wheel, so that energizing the ac solenoid positively moves the rheostat arm from one contact to the next. Mechanism is arranged to prevent the arm traveling too far because of inertia of the moving parts.

Rheostat resistance is divided between contacts so that generator voltage reaches about 40 v on average load when 40 contacts have been cut out by the arm. Similarly when 50 field-rheostat contacts are cut out generator voltage is about 50 v. Because of the flat compounding of the dc generator, voltage variations are small for a given rheostat-arm position with load changes. However, the voltage is always determined by a voltmeter relay and the rheostat-arm position changed slightly to compensate for any slight voltage changes.

As shown in Fig. 3, power for the control circuits is taken from the load side of the 440-v ac motor starting switch and stepped down to 110 v. Motor-driven solenoid cam $C$, Fig. 3, corresponds to cam $C$, Fig. 2. As this cam rotates it closes and opens solenoid contact $S_1$ to actuate the solenoid-operated pawl that positions the field-rheostat arm. Cam $C$ is driven by motor $M$, Fig. 3. Cams $C_1$, $C_2$, $C_3$ and $C_4$ are driven by motor $M_1$ to open and close contacts $A_1$, $A_2$, $A_3$, $A_4$, and correspond to cams $C_1$ and contacts $A_1$, Fig. 2. Contacts $R$, $R_1$ and $R_2$ are closed and opened by cams $C_5$, $C_6$ and $C_7$ on the field rheostat. At the start of the cycle (start-stop contact) $R$ is closed, while $R_1$ and $R_2$ are open.

### *Control Put in Service*

Switch $B$ is closed to put the control in service and the rheostat wheel is turned counter clockwise four notches to the start position. The latter closes start-and-stop rheostat contact $R$. A circuit is now completed for the solenoid cam motor from $X$ on the transformer through motor $M$, contact $V$ on the voltmeter relay, start-stop contact $R$, self-stop contact $A_1$ back to the transformer. Motor $M$ starts and drives cam $C$ to open and close contact $S_1$ in the field-rheostat actuating-solenoid circuit. When contact $S_1$ closes it makes a circuit from $X$ through $S_1$, the solenoid coil, back to the transformer. Energizing the solenoid causes it to pull down its core to move the rheostat arm from one contact to the next.

Motor $M$ drives cam $C$ at 1 rpm. This cam has 4 projections that open and close contact $S_1$, so that 4 impulses per minute are produced in the solenoid circuit. The rheostat arm therefore moves over 4 contacts in 1 min, or 40 in 10 min. At the end of this time generator voltage has increased to 40 v, and voltmeter relay opens contact $V$ to stop motor $M$ and close $V_1$ to start timer motor $M_1$. This circuit is from $X$ through motor $M_1$ contacts $V_1$, $R$ and $A_1$, back to the transformer.

While the timer motor revolves, voltage normally remains at 40. However, if for any reason it is below 40, the relay closes contact $V$ to adjust the field rheostat for 40 v. This causes an increase in the timing period that is so small it may be overlooked.

When the timer has revolved 5 min voltmeter-relay cam $C_3$ opens its contact $A_3$ and connects resistance $T$ in ser-

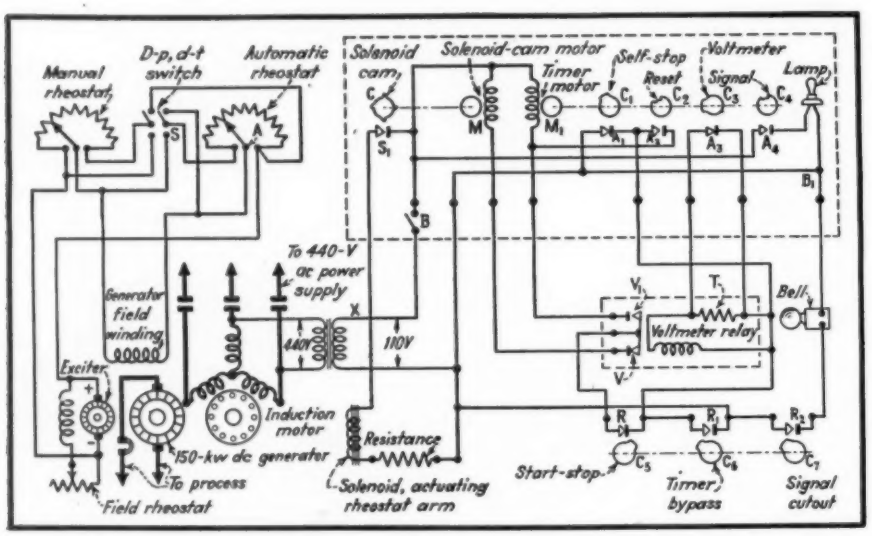



Fig. 3—Field rheostat and automatic-timer circuits for a cycle in which the voltage is increased from 0 to 40 v in 10 min, held at 40 v for 5 min, then raised to 50 v in 3 min, held at 50 for 2 min to complete the cycle, total time 20 min.

ies with the coil of the relay which now opens the timer motor-circuit contact $V_1$ and closes the solenoid-cam motor circuit through contact $V$. The solenoid now functions to increase generator voltage to 50 v in about 3 min. When this voltage is reached, voltmeter relay operates to stop the rheostat and again start the timer motor.

As the timer revolves, voltmeter cam $C_3$ releases contact $A_3$ so it is ready for the next cycle. When the timer revolves for 2 min, the alarm-and-signal contact $A_4$ closes and the self-stopping contact $A_1$ opens which, in turn, stops the timer. The signal circuit is from $X$, contact $A_4$, the signal lamp and back to the transformer. Alarm-bell circuit is from $B_1$ through the bell contact $R_2$, back to the transformer.

When the alarm rings, the operator turns back the rheostat to the starting position, which opens contact $R_2$ and stops the bell's ringing. Turning back the field rheostat also opens the start-stop contact $R$ to prevent the solenoid from operating. At the same time, by-pass cam closes contact $R_1$, starting the timer which revolves slightly, closes its self-stopping contact $A_1$ and opens its resetting contact $A_2$. The latter stops the timer in a position for the next cycle of operation. Signal light and alarm contacts $A_4$ are also opened to break the circuits of these devices until near the end of the next cycle.

By changing timer-gear ratios, the voltage control periods can be changed to suit a longer or shorter operating cycle. The timer can also be arranged to stop the motor-generator set at the end of each cycle instead of sounding an alarm.

# Large Synchronous Motor Dynamic-Brakes Its Load

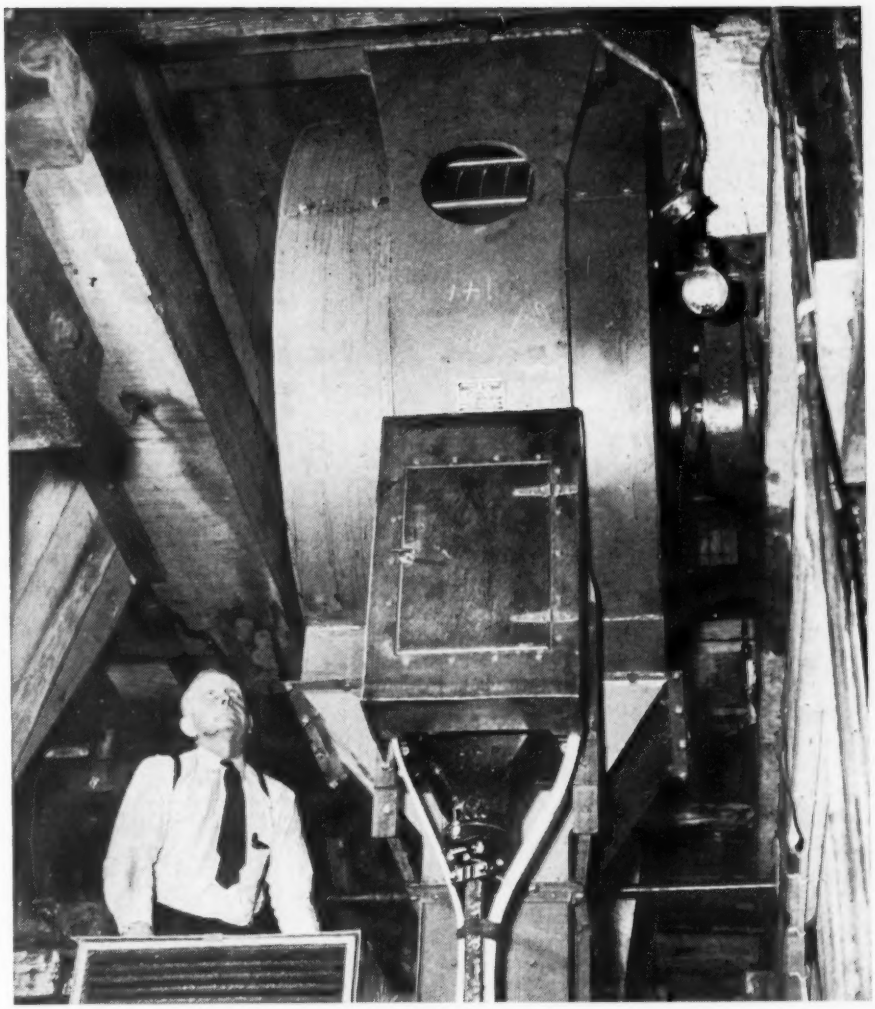
▶ HANGING FROM THE CEILING, this 250-hp General Electric synchronous motor drives directly one of the large bandsaws at the Hammond Lumber Co Plant No. 2, Eureka, Calif. Featuring dynamic braking, the motor was installed as part of a recent modernization program at this large West Coast mill.

Because of dust, ventilating air before entering the motor is taken through the filter, shown at bottom left of the photo.

To overcome quickly the high inertia of the motor's rotor and bandsaw wheels when stopping, dynamic braking is used. This is done by connecting a resistor across the motor's stator winding after it is disconnected from the power line and leaving the field coils energized. Under these conditions the motor functions as an ac generator while it is being driven by the inertia of the mill. The braking resistor loads the generator, whose energy output is dissipated as heat in the former.

A cabinet on the motor contains both its stator-winding terminals, and potheads to disconnect the motor from the high-voltage line, the controller being mounted in a separate location. An interlock on the cabinet's door prevents its being opened until the controller has been de-energized.

Rotor of the motor and the bandsaw's lower bandwheel are keyed to a common shaft. The motor's stator bolts to the band-mill frame, which also carries the bandwheel and rotor shaft. This arrangement insures maintaining alignment between motor parts and the bandwheel at all times.



**This 250-hp synchronous motor hangs from the frame of the large bandsaw that it drives directly, and has its control arranged for dynamic braking for quick stops. This is done by connecting a resistor across the motor's stator winding after it is disconnected and leaving the field coils connected to the excitation source**

# How to Install and Maintain Diesel Valves, Seats and Guides—II

***J D Creek, Thompson Products, Inc, concludes a comprehensive discussion of tested procedures for valve installation and maintenance, based on 25 years' experience in shop and field***

▶ THE JOB OF INSURING topnotch valve operation does not stop with proper installation and maintenance of the valves, seats and guides. Lubrication, spring condition, timing, and cooling all affect valve operation and life and thus must form part of the servicing program. Here are practical pointers on these latter phases of valve maintenance.

Although many operators inquire about valve-guide lubrication, I know of no lubricant available that can be recommended as entirely suitable for this application. Probably the most effective and least injurious is a solution of 50% kerosene and 50% upper-cylinder oil. Where lubrication connections direct to the guides are provided, some operators install zerk fittings and apply chassis lubricant by grease gun. This scheme seems to give reasonable satisfaction.

My experience indicates that it is better to under-lubricate valve stems than to over-lubricate them, because valve-stem and guide wear are preferable to a burned valve which may result from a gummed, sticking stem. To alleviate lubrication and wear problems partially, one valve manufacturer furnishes heat-treated nickel-iron guides with a ground or honed finish in the bore. These, with heat-treated valve stems running in them, serve for unusually long periods with little or no lubrication.

### *Improved Valve Springs*

Since the advent of the stroboscope, long strides have been made in study of valve-spring action and with the knowledge so gained better springs have been built. Naturally, this progress has been most marked in the automotive and aviation fields because of the more obvious results of spring defects on high-speed engines. However, low- and medium-speed industrial engines have occasional valve difficulties and the operator should know how to recognize them and what to do to cure them.

Most common valve-spring troubles in industrial engines are breakage and hammering-out of the valve seat. Each case of spring breakage must be treated individually and all factors that might contribute to failure analyzed. Spring breakage often occurs when an engine is operated at constant speed, as on generator drives. This is particularly true where there are two springs per valve. This often results from a vibration harmonic set up in the spring, which eventually causes fatigue failure. Considerable experimentation may be needed to eliminate such harmonics. Try a stronger spring, one having a greater, or lesser, number of coils, or one having a certain number of coils part way and a lesser number on the remaining length of the valve spring.

### *Direction of Winding*

Where there are two springs per valve, it is important that the lead winding of the inner and outer springs go in different directions. In other words, if the inner spring is left-hand wound, the outer spring should be right-hand wound. Inasmuch as air-starting-valve springs give considerable trouble from corrosion, it is advisable to specify springs made of stainless-steel wire.

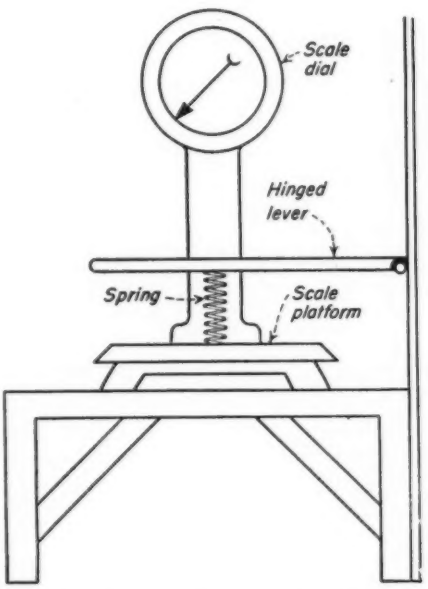



**Fig. 1—Hinged lever compresses spring on small platform scale to compare the strength of old springs with a new one**

Contrary to the opinion widely held by industrial-engine operators, hammering-out of the valve seat often results from a spring that is too weak rather than one that is too strong. This holds true, of course, only on cam-operated valves and where rocker-arm or tappet clearances are those specified by the engine builder. Obviously, on cam-operated valves, if the spring is sufficiently strong the valve exactly follows cam contour and strikes with only the force developed in the space provided for rocker-arm or tappet clearance. This points up the importance of maintaining proper clearance at these points. However, if a weak spring operates a sticky valve, the cam may leave it, and when the valve finally closes it strikes the seat with considerable impact, hammering it out.

Valve springs should be checked for compression pressures at the time of each valve servicing and between these periods if springs show signs of weakness. If a regular tester is unavailable, the operator may conduct a comparison test by using a small platform weighing scale set up under a drill press or a lever hinged at one end, Fig. 1.

With the drill press or lever arrangement, compress a new factory-equipment spring to its operating length with the valve completely open. Note the reading on the scale. Now follow the same procedure on the used springs, comparing the scale readings with that of the new spring. Those that show more than 10% variation under the compression pressure of the new spring should be replaced.

### *Exhaust-Valve Timing*

Exhaust-valve timing of 4-cycle engines strongly influences operating efficiency and life expectancy of valve parts. An example from the automotive field illustrates this. The 1940 DeSoto engine, although identical in all respects with the 1939 unit, was rated 100 hp instead of 93 hp, the gain of 7 hp resulting from opening exhaust valves earlier and higher, and closing them later. This improved scavenging, which accounted for the higher output.

In a paper* presented in 1940, B L Rogers and O H Moore, supt and asst supt of compressor stations, respectively, of the Lone Star Gas Co, say, "It is common practice to time an engine by opening the inlet valve ahead of dead center, without considering the exhaust stroke of the preceding cycle. If conditions are such that spent gases are not scavenged from the cylinder, it stands to reason that the volume of the new charge will be reduced in direct proportion to quantity of spent gases trapped in the cylinder.

### *Incomplete Scavenging*

Incomplete scavenging of a cylinder has a very detrimental effect on the running of an engine because: (1) The spent gases must be expanded to below atmosphere before any of the new charge is admitted to the cylinder. This uses up piston displacement and is the equivalent of reducing cylinder dimensions. (2) These spent gases are hot and increase the temperature of the new charge as it is drawn from the cylinder, thereby reducing the net volume of the mixture that can be drawn into the cylinder. (3) They do not assist in the combustion of the new charge, but actually change the compression and burning characteristics of the mixture.

"In the past, our operators timed an engine from the inlet valve (setting the opening point according to valve clearances on the cold engine) and then expected it to operate efficiently. All of these careful adjustments may have been for naught, for we have found inlet valves opening as much as 18 deg later after the engine came up to running temperature.

"When an engine is adjusted by the use of instruments, the operating characteristics are shown under actual running conditions. This means that any wear affecting operation of the unit will show up in the data recorded by the instruments. Because wear manifests itself to a greater extent in the exhaust than in the inlet mechanism of the 4-cycle engine, the operation of the exhaust valve is often thrown out of synchronism with the piston travel when engines are timed by the inlet valve only. We have adopted the practice, therefore, of timing our 4-cycle engines by the exhaust valve, using the exhaust curve of the light-spring indicator diagram as our checking medium."

In trying to obtain maximum service and life from valve parts, the operator must give attention to ignition timing as well as valve timing. To quote Rogers and Moore again: "The ignition point of the fuel charge ties very closely to proper valve setting and compression pressure. One could be very careful in determining the most satisfactory valve timing and compression and have this work offset if the charge were not ignited at the proper point. Early ignition results in loss of power by bringing about maximum pressure too early in the cycle. Too-late ignition results in loss of power through maximum pressure not being reached sufficiently early to overcome a rapidly increasing volume created by the receding piston."

I might add to this that late ignition timing can be much more injurious to exhaust-valve parts than early ignition, because the burning gas, following the piston on the power stroke, escapes through the exhaust valves before it is cooled by the process of expansion.

### *Accurate Spark Timing*

The operator can time a spark-ignition engine accurately with a stroboscopic neon timing light. To use this instrument the operator must mark the flywheel, if it is not so marked already, for exact top dead center (tdc) and for the specified firing position of each cylinder. Tdc may be found by using a dial indicator on top of the piston or, less preferable, a spirit level on the crankshaft. Fig. 2 outlines a somewhat longer but accurate method. Mark tdc, however found, on the flywheel and set up on the engine frame a pointer indicating it. The firing point may be found by measuring the flywheel circumference and dividing the dimension in inches by 360 deg. This gives the number of inches per degree. Assume it works out to one inch per degree and ignition is supposed to occur 20 deg before tdc. The firing-point mark on the flywheel should be 20 in. before the tdc mark in direction of rotation, and is indicated by a thin stripe of white paint. Now hook the neon timing light in series with the spark plug of the cylinder being tested. With engine operating at normal load, let flashes from the timing lamp show up the white ignition-point stripe on the flywheel. If this white stripe shows up at the exact position of the pointer, ignition is correct. If not, make needed adjustments.

### *Good Cooling Important*

Don't overlook the part proper cooling plays in improving valve operation and increasing parts' life. Installations boasting closed systems and treated water usually offer few problems along this line. However, where such equipment is not in use, exercise great caution to see that cylinder-head water jackets and passages are kept open and free of scale. This is particularly true on engines relying on gravity flow of jacket water where no turbulence is created to carry away scale formed. It is easy to see how plugging of a water passage in one side of the head creates a hot spot in that area, causing distortion of the head and possibly a leaking valve or loosened seat insert.

* "Four-Point Control of the 4-Cycle Gas Engine" by B L Rogers and O H Moore, Lone Star Gas Co, presented before American Gas Association, 1940.

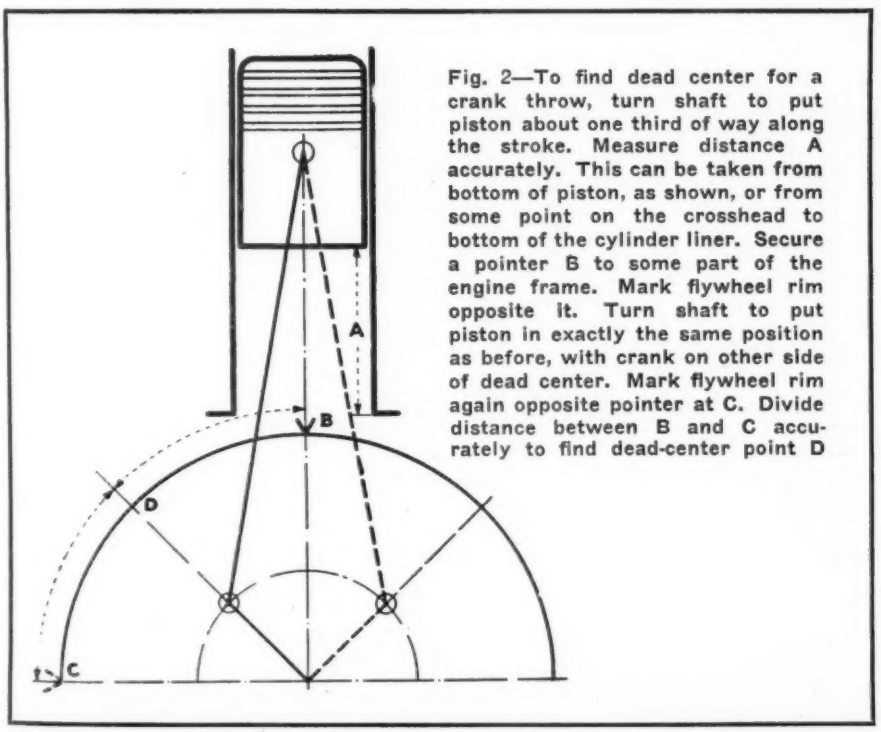



Fig. 2—To find dead center for a crank throw, turn shaft to put piston about one third of way along the stroke. Measure distance A accurately. This can be taken from bottom of piston, as shown, or from some point on the crosshead to bottom of the cylinder liner. Secure a pointer B to some part of the engine frame. Mark flywheel rim opposite it. Turn shaft to put piston in exactly the same position as before, with crank on other side of dead center. Mark flywheel rim again opposite pointer at C. Divide distance between B and C accurately to find dead-center point D

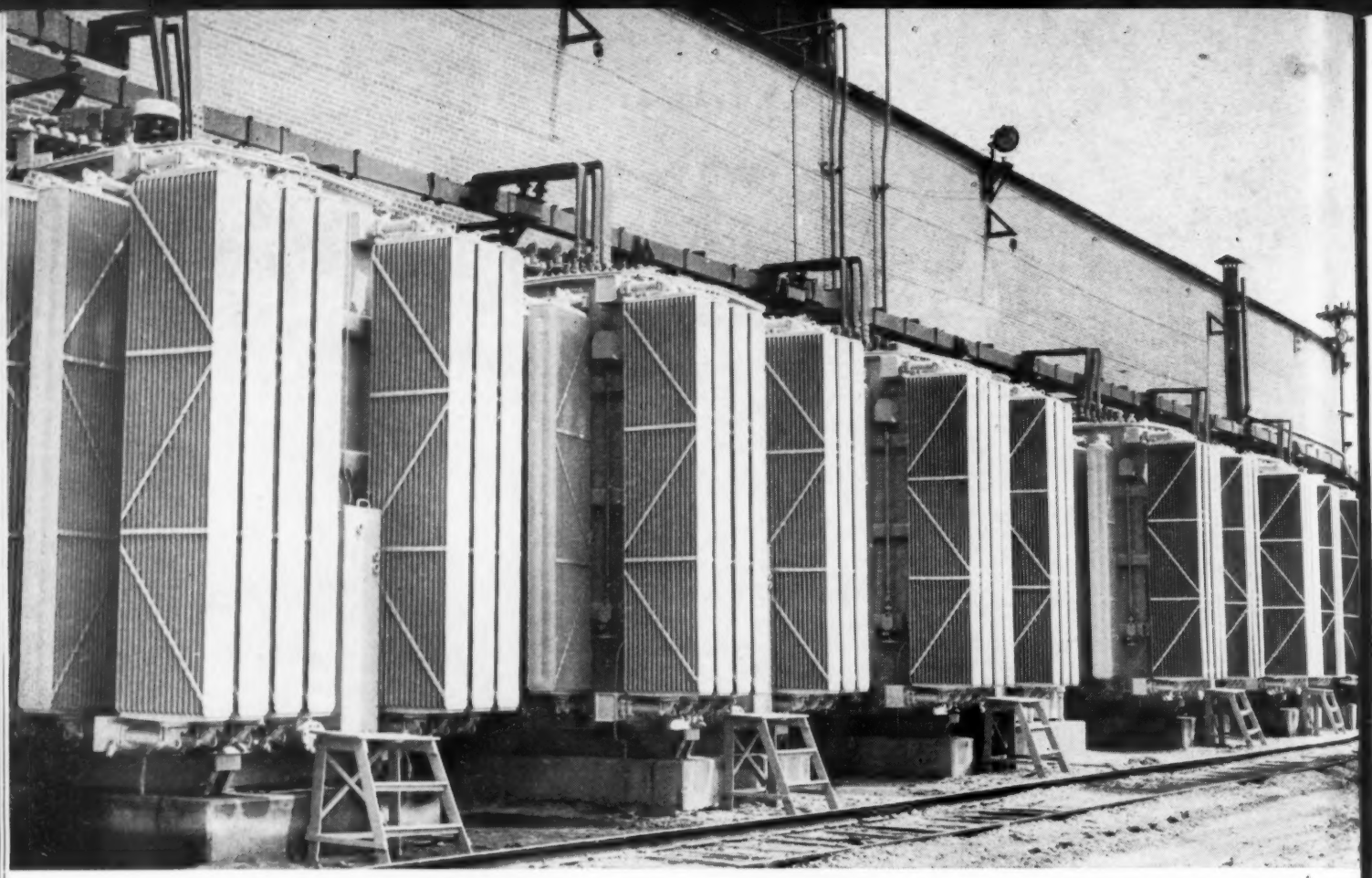


**Fig. 1—Each 6550-kva transformer, feeding the 24-cell ignitron rectifier banks, has a double-quadruple "Y" secondary. Overhead exposed bus brings power to the banks; six single conductor cables transmit secondary power to the rectifiers**

# New and Rebuilt Electrical Equipment Speeds Power for Urgent Process Needs

***Equipment shortages didn't stand in the way when Dow Magnesium needed wartime power. In the second of three articles, J P Warren, power superintendent, and W J Coughlin, electrical engineer, describe electrical design of speedily built plant***

▶ THE ELECTRICAL SYSTEM of the Dow Magnesium Corp war plant at Velasco, Texas, includes equipment necessary to serve 216 electrolytic cells for manufacturing magnesium. The original design was for 147,000-kva generating capacity inter-connected with the Southwestern Power Pool through a 48,000-kva transmission line to the Houston Lighting and Power Co. The power system is a modified straight-line layout from generators to their respective feeder buses. Fig. 2 shows a single-line diagram of the electrical layout. The design consisted of an assembly of repaired generating equipment, all old and some considered obsolete, and new equipment assigned to the project by the Defense Plant Corp, or made available from other sources.

Generator No. 1 is a Westinghouse 43,750-kva 80%-pf 14.2-kv 1200-rpm machine, which was removed from Hell Gate Station in New York City. This unit was rehabilitated by removing and heat-treating the laminations and installing new coils insulated with spun glass. The field was rewound and equipped with new cooling fans. Temperature-detecting coils were embedded in the windings to record operating temperatures.

Shaft-driven main and pilot exciters supply excitation. Both are cooled with air diverted from the main-generator supply of 100,000 cfm. A surface air cooler of 21,660 sq ft area removes heat from the air circulated over the stator and field.

This generator is Y-connected with main leads extended to the No. 1 feeder bus. Midpoint of the "Y" is connected to the neutral bus, which is grounded through a 4-ohm resistance.

Generator No. 2, a General Electric 50,000-kva 90%-pf 12.2-kv 1200-rpm machine, was removed from the Conners Creek plant of Detroit Edison Co where it had been disassembled and stored. Some minor changes were made on its blower shields and collector rings. The winding, installed in 1926, was not rewound as it was in good condition. Original insulation was class B, consisting of asbestos and mica tape. Temperature-detector coils had been embedded be-

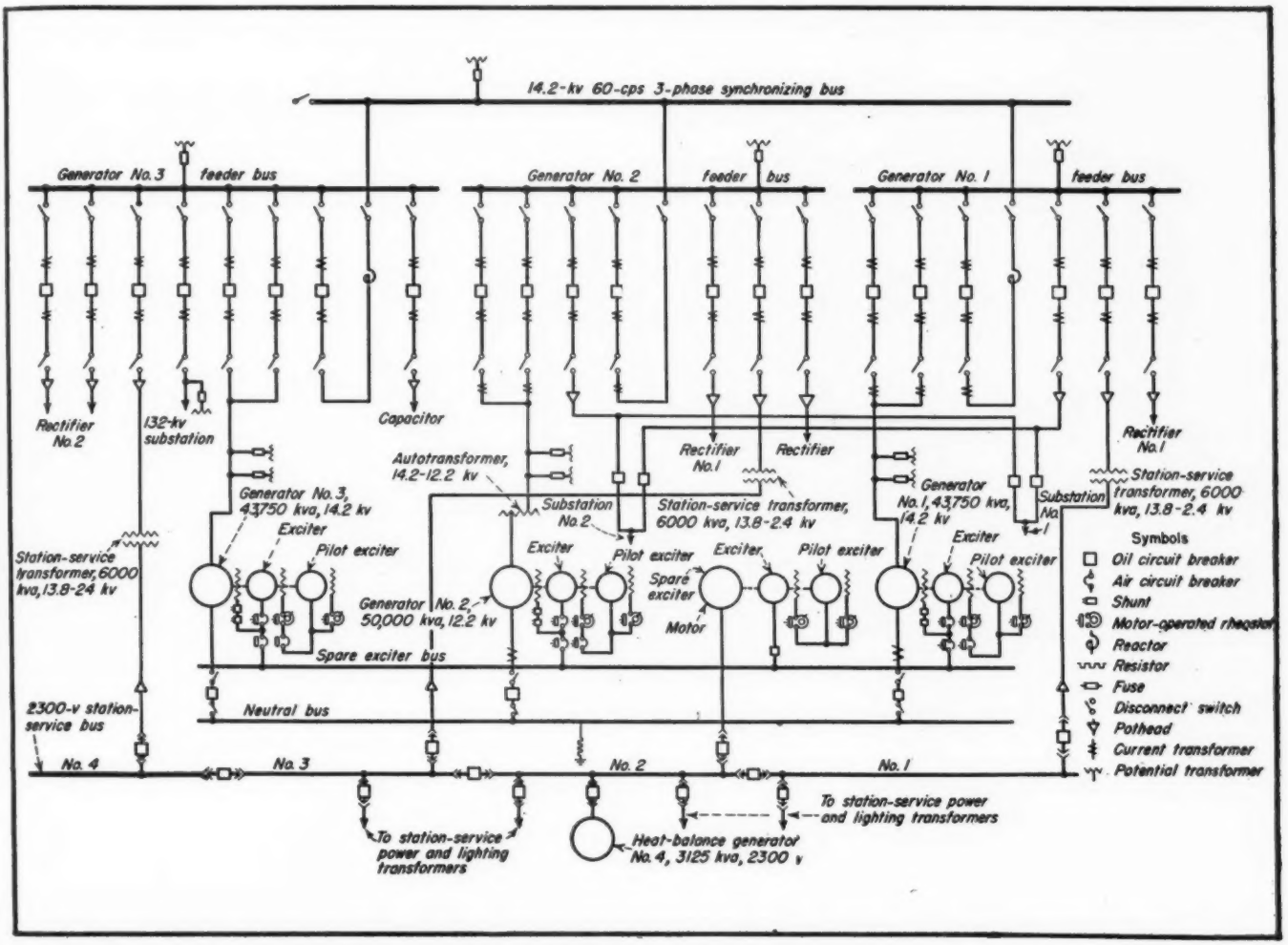



**Fig. 2—Single-line electrical distribution. Power-system layout is modified straight line from generators to load**

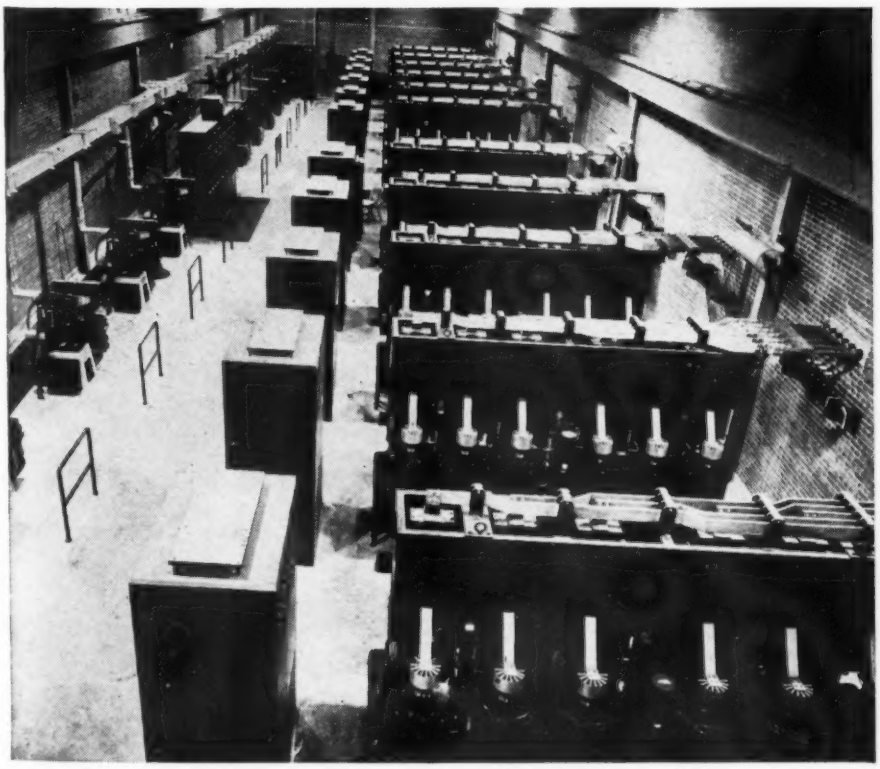


**Fig. 3—Rectifier banks rated at 10,000 amp are used to supply dc power to the electrolytic cells. Each separate 10,000-amp bank contains 24-ignitron vacuum tubes**

tween the coils and at the bottom of the slots for recording the temperatures. The main exciter was direct-connected to the generator shaft but had a motor-driven pilot exciter, which was replaced by an exciter connected direct to the main shaft.

The generator voltage of 12.2 kv is stepped up to 14.2 kv in a 50,000-kva 3-phase autotransformer, which is connected to the No. 2 bus section. The auto-transformer is an outdoor type, oil immersed, air cooled with 55-F rise. It has a delta tertiary winding to stabilize the neutral.

Generator No. 3 is a new General Electric 43,750-kva 80%-pf 14.2-kv 3600-rpm hydrogen-cooled machine. Capacity was increased to 43,750-kva from 37,000 by cooling with hydrogen instead of air. By raising the hydrogen pressure from 0.5 psig normal to 15, the rating is increased to 50,400 kva. The field of this unit was wound with aluminum to de-

crease the weight and substitute for copper, which was scarce during the war. The machine has a transposed Y-connected winding with class B insulation. Midpoint of the "Y" is connected to the neutral bus.

The main and pilot exciters are direct-connected to the generator shaft through gears that reduce speed to 1725 rpm. Load control for this generator, whose prime mover is a topping turbine, is by backpressure governor regulation.

Generator No. 4, a second-hand General Electric 3125-kva 80%-pf 2300-v 3600-rpm machine, was rebuilt on the job. It is used as a heat-balance unit and its leads are connected direct to the 2300-v station-service bus. A spare 200-kw motor-driven exciter is for emergency use.

The electrical power bay is separated into three bus-section compartments with double firewalls between them. The synchronizing bus, which extends the entire length of the electrical bay, is inclosed in a steel duct. Each bus section is protected by differential relays.

Control circuits are interlaced between the control boards and the various switchgear, and load centers in the control-cable bay. Flexible and rigid conduit is supported on a steel framework for the circuits in the bay. Fig. 4 shows a section of this bay and demonstrates the flexibility of this type of routing for control circuits as used in large power plants.

**Fig. 4 (above)—Electrical control bay showing routing of control cables and conduits. This accessible system, which uses flexible conduit mounted on both sides of steel-supporting framework, can be turned into and out of group at will. Fig. 5 (below)—Phase-shifting transformers change phase relations for two of three transformers feeding 24-cell 10,000-amp ignitron rectifier banks**

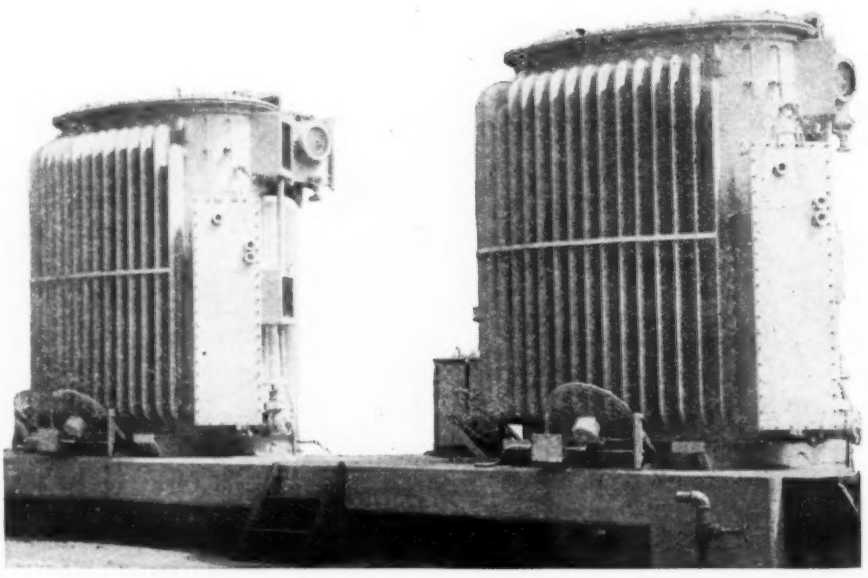
### *Rectifier Power Feeders*

Power is fed from the bus sections to the rectifier circuits through single-conductor 2,000,000-circular-mil cables, which are armored with calcium bronze and protected with special corrosion-resistant paint against the chlorine atmosphere. The cables are terminated in potheads at the 27,500-kva transformer, which in turn feeds three 6550-kva rectifier transformers through overhead exposed buses, as in Fig. 1. One of these transformers is fed directly and the other two are each fed through a 6950-kva phase-shifting transformer, Fig. 5. Each rectifier transformer has a double-quadruple "Y" secondary, which feeds a 24-cell ignitron bank. The banks feed the dc power to the electrolytic cells. There are nine water-cooled complete rectifiers each rated 10,000 amp, Fig. 3. Heat exchangers are installed so fresh water can be circulated through the units, and sea water used to dissipate the heat.

The transmission line from the Houston Lighting and Power Co connects to the No. 3 bus through a 32,000-kva transformer bank. This transmission-line circuit is completely equipped with relays to protect the power stations at each end from faults.

The entire electrical control system is operated from dc supplied by batteries at important points. Conventional controls and alarm circuits are installed in the system.

The electrical system provides sufficient flexibility to give the continuity of service demanded by the refining process.



# Inhibitors in Turbine Oils Reduce Oxidation and Prevent Rust

***Satisfactory lubrication of new turbines demands an oil that has oxidation stability and acts as a rust preventive. Dr E W Gardiner, research chemist, California Research Corp, gives the results of recent tests for these important properties****

▶ LIKE MANY OTHER PETROLEUM PRODUCTS, turbine oil must perform several operations satisfactorily. Its primary function is to lubricate various bearings, gears and auxiliary equipment. Probably the most important property of a lubricating oil is viscosity, which for optimum operation is definite for each type of turbine. Manufacturers generally define oil requirements with respect to viscosity. Turbine oil also dissipates heat in an oil-circulating system, and lubricates and actuates the governor mechanism. To avoid maintaining another lubricating system and stock of oil, turbine oil is often used for auxiliary equipment. To perform these functions satisfactorily over a long period, it should have, in addition to proper viscosity and high flashpoint, these other properties: oxidation stability, rust prevention, ability to separate from water, noncorrosiveness to bearing metals and low tendency to form foam.

In general, all oils manufactured for turbine lubrication have been refined so they separate quickly from water; therefore, this characteristic needs no further improvement. Turbine oils are pure mineral oil and, accordingly, are noncorrosive to bearing materials. Refining is generally done in such a way as to eliminate from oil all substances that attack bearing metals. The low viscosity at operating temperatures assists in breaking foam. The most important properties that require improvement to lubricate the newer turbines satisfactorily are oxidation stability and rust prevention.

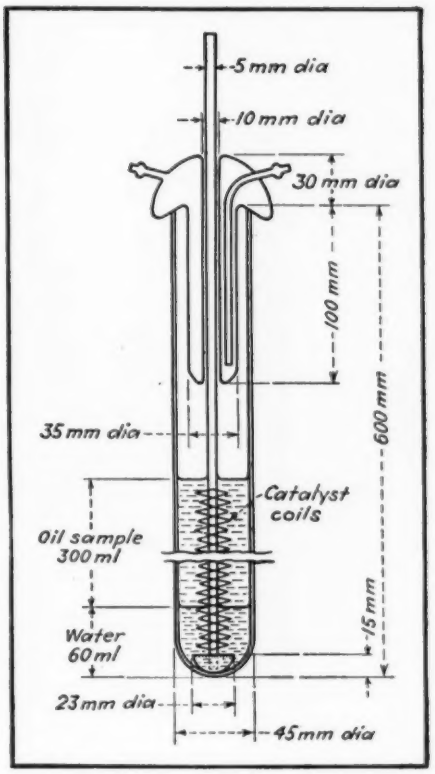



**Fig. 1—Apparatus for ASTM test of the lubricating oil's oxidation stability**

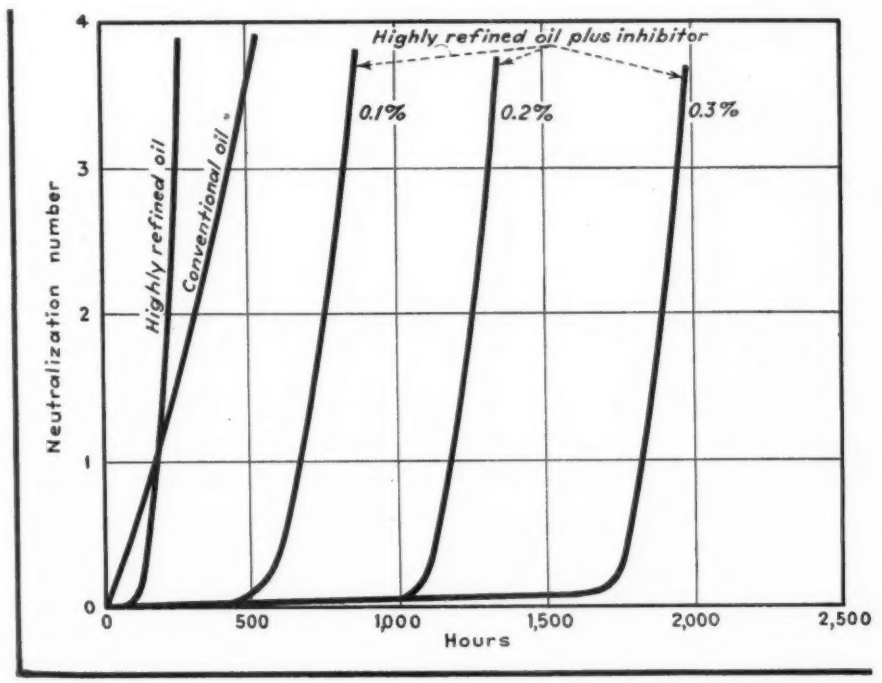



**Fig. 2—Change in neutralization number with time for oil samples tested by oxidation apparatus. Time to reach a number of two increases with added inhibitor. However, when the oxidation once starts it progresses very rapidly**

There are many ways of evaluating oils for oxidation stability. An ASTM committee has proposed a test method that consists of air agitation of oil and water at 205 F in the presence of copper and iron catalysts, as agents that accelerate the process, so the operating details simulate conditions in a turbine. Fig. 1 shows the laboratory apparatus for this test. The criterion of oil failure is the increase in neutralization number, which is defined as the weight in milligrams of potassium hydroxide (KOH) required to neutralize the acid condition in one gram of the oil. When the neutralization number has increased to two milligrams of potassium hydroxide (KOH) per gram of oil, the test is over.

Tests made by the proposed ASTM procedure show marked differences between the older turbine oils and the new inhibited, highly refined oils. Some straight mineral oils may last as long

* This article is based on a paper presented by Dr. Gardiner to the Pacific Coast Electrical Assn.

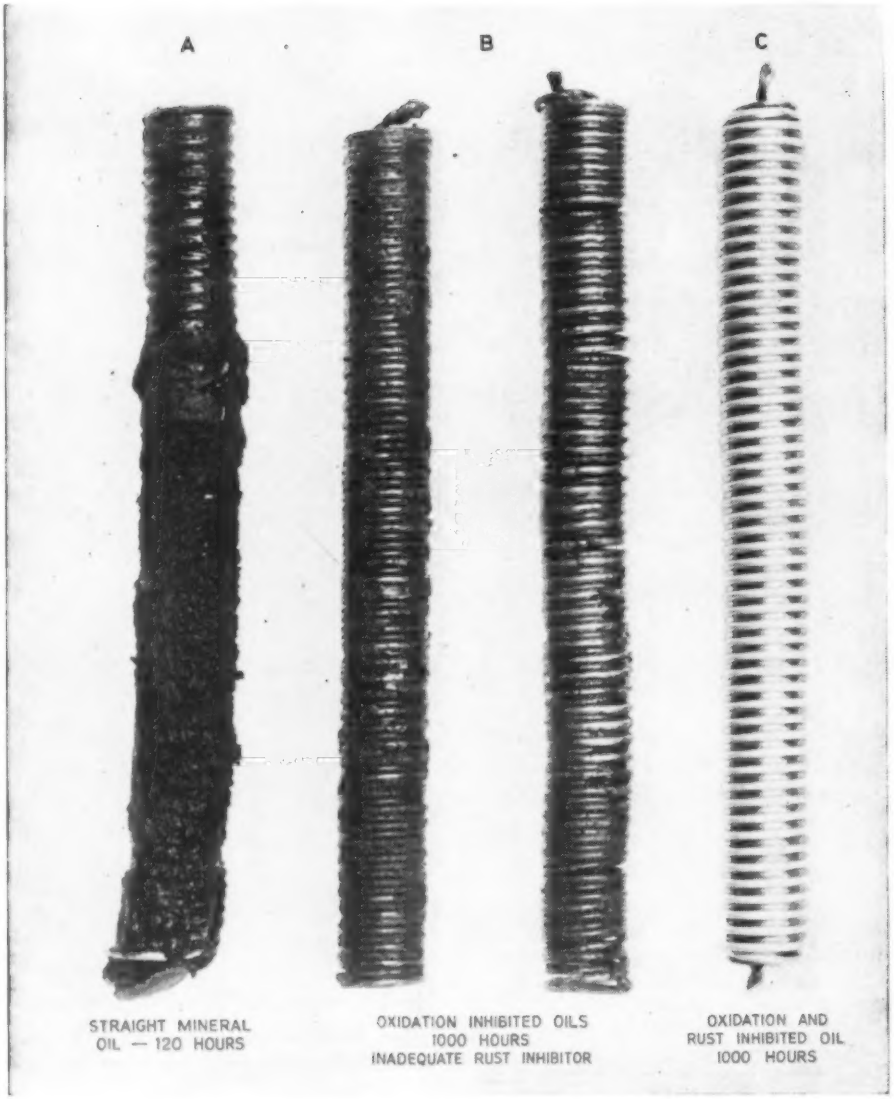

A
B
C
STRAIGHT MINERAL OIL — 120 HOURS
OXIDATION INHIBITED OILS 1000 HOURS INADEQUATE RUST INHIBITOR
OXIDATION AND RUST INHIBITED OIL 1000 HOURS

**Fig. 3—Condition of catalyst in oxidation tests of oil. A: uninhibited oil deposits large amounts of sludge on catalyst; C: inhibited oil does not affect the catalyst**

as 300 hr in this test before the neutralization number reaches 2 but may oxidize in 100 hr. Oils properly inhibited against oxidation may last for 2000 hours or more. The ASTM committee considers a life of 1000 hr in the turbine-oil oxidation test satisfactory.

During the oxidation test a carbonaceous sludge usually forms. The quantity of oxygen reacting is much greater than the quantity of acid measured because oxygen is present in the sludge as well as in the form of acid in the oil. For an uninhibited oil, sludge collects on the catalyst as a black deposit, shown at *A*, Fig. 3.

The base oils for the new inhibited oils oxidize differently in the ASTM test. There is no evidence of oxidation for about 100 hr and then it takes place rapidly, more so, in fact, than for a conventional mineral oil. The inhibited oils behave similarly except that they remain stable many more hours. This interval, called the inhibition period, is dependent upon the amount of inhibitor present. During the period there is no material change in the oil with respect to viscosity, emulsifying tendency, surface tension and color. Shown in Fig. 2 are curves of change in neutralization number with respect to time as determined by the oxidation test for a highly refined oil, a conventional oil and three inhibited oils containing different amounts of the same inhibitor.

One basis for changing oil in a turbine is the increase in neutralization number. Satisfactory service for thousands of hours has been obtained with many conventional oils before reclaiming was necessary. In the accelerated ASTM oxidation test, a life of 100 hr may be obtained for a conventional oil that can be used in a turbine for 20,000 hr before reclaiming is necessary. The ratio of service life to time in the accelerated ASTM test may be as high as 200 to 1.

If a ratio of only 100 to 1 is attained for the new inhibited oils, which last for 1000 to 2000 hr in the accelerated test, service life of 100,000 to 200,000 hr (10 to 20 years) may be expected. The turbine lubricating system during this time is free from carbonaceous sludge; the viscosity of the oil does not change and the color remains constant. After oxidation begins, the change in the oil may be more rapid than with the conventional oils but there is ample indication to permit the operator to change the oil before acid concentration becomes dangerous to the bearing metal or other parts.

A comparison of service life for a conventionally refined turbine oil and an inhibited oil is shown in Fig. 4. The conventionally refined oil reached the neutralization number of 2 after 18,000 hr of operation, but the inhibited oil had not changed in neutralization number during the same period.

### *Test Results*

ASTM turbine-oil tests show the effect of oxidation in more ways than by increase in neutralization number. Sometimes deposits form on the catalyst and the oil may turn green because of reaction of the acids formed with the copper. Fig. 3 shows the catalysts after oxidation of several oils. The first catalyst at *A* was used in an oil without an inhibitor and lasted only 120 hr before the neutralization number had risen to 2. Because of oxidation of the straight oil, a heavy carbonaceous deposit mixed with rust had formed on the catalyst. The deposits on the two catalysts at *B* are not carbonaceous material but are rust due to the action of the acids formed by oxidation on the iron. This test is not concerned with the rust-preventing characteristics of the oil but it does give an indication of this property. The third at *C* was used in an oil containing an oxidation and rust inhibitor. This catalyst is completely unaffected or discolored.

Simultaneous action of oxygen and water causes rusting of iron and steel. Properly refined, oil does not cause rusting and may prevent it. Some lubricating-oil distillates and even conventionally refined oils often have some rust-preventing properties. However, an additive is needed for positive insurance against rusting. As the result of a great deal of study a number of materials have been found that reduce rusting noticeably. Such a preventive has to pass rather rigid requirements to be satisfactory in a turbine oil. It must not affect the oxidation stability, nor change its emulsifying characteristics, nor be soluble in water. Al-

though these requirements are difficult to meet there are several rust preventives that are used with success in turbine oils.

Considering the time spent in laboratory study of rust preventives, little is known about their function. Apparently they prevent rust by forming a bond with the metal in such a way as to keep water and oxygen from reaching the metal. Organic substances differ in the tightness with which they cling to metals. Polar substances such as acids, esters and salts have the ability to attach themselves firmly to metals. The higher-molecular-weight fatty acids, like stearic and oleic, and their salts are rust preventives, but they have disadvantages such as a tendency to produce emulsions, and are corrosive to bearing metals.

There are many ways to measure an oil's rust-preventing properties, depending on the degree of protection demanded of it in service. The ASTM committee has published a tentative method, D-665-44-T, as the result of co-operative work based on a test proposed by chemists of the General Electric Co. Briefly, this test consists of suspending a polished cold-rolled steel strip or rod in a well-agitated mixture of oil and water for 48 hr at 140 F. Fig. 5 shows the apparatus for this test. The mixture, containing 300 ml of oil and 30 of water, is stirred at a rate of 1000 rpm. At the end of the 48-hr stirring period the steel specimen is examined carefully for rust. The oil is considered satisfactory if the steel is free of rust spots. For consistent results, great care must be taken, particularly in handling the steel specimens.

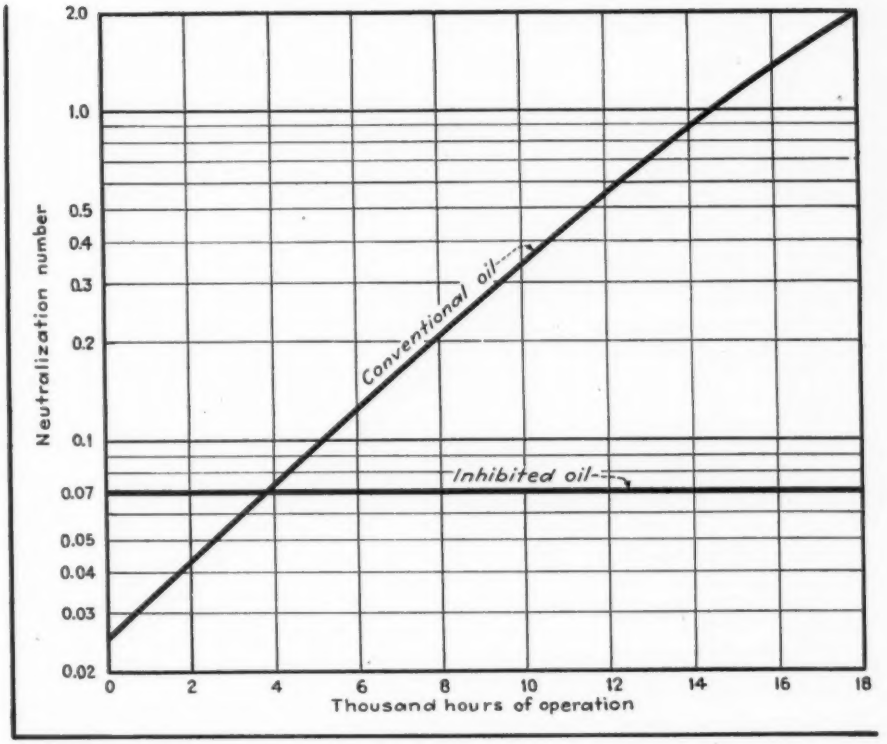



Fig. 4—Comparison of service life for conventionally refined and inhibited oil

Fig. 6 shows the test specimens from four oils. The first, at *A*, shows the result of a conventionally refined oil that did not contain a rust preventive. This specimen was coated with a heavy deposit of rust at the end of the test. The second sample, at *B*, was obtained by using an oil containing an oxidation inhibitor capable of passing the proposed ASTM oxidation test but without a rust prevent-

(*Continued on page* 140)

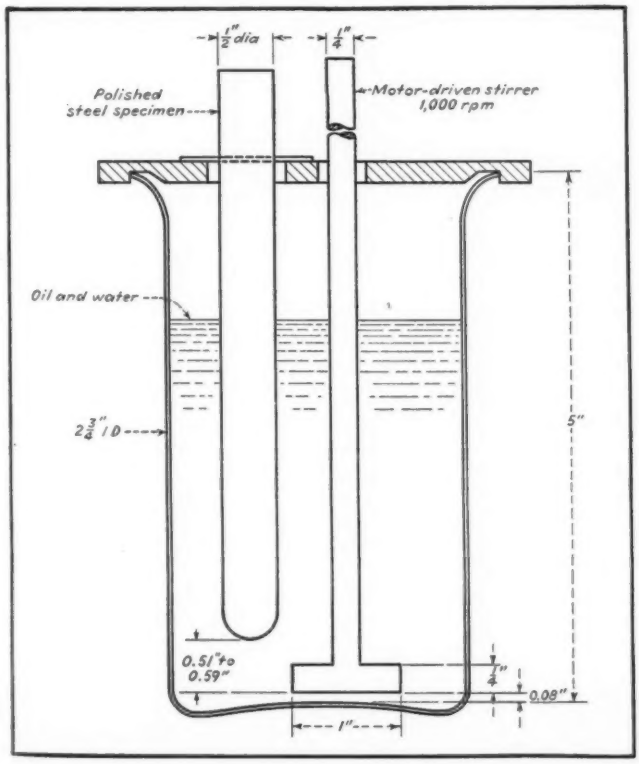



Fig. 5—Laboratory apparatus recommended by ASTM method, D-665-44-T, to test the rust-preventing properties of the lubricating turbine oil described here. The mixture contains 300 ml of oil and 30 of water. It is stirred at 1000 rpm for 48 hr; then specimen is inspected for rust

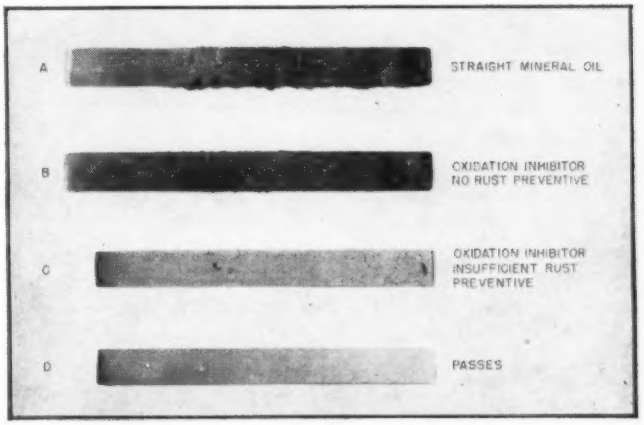
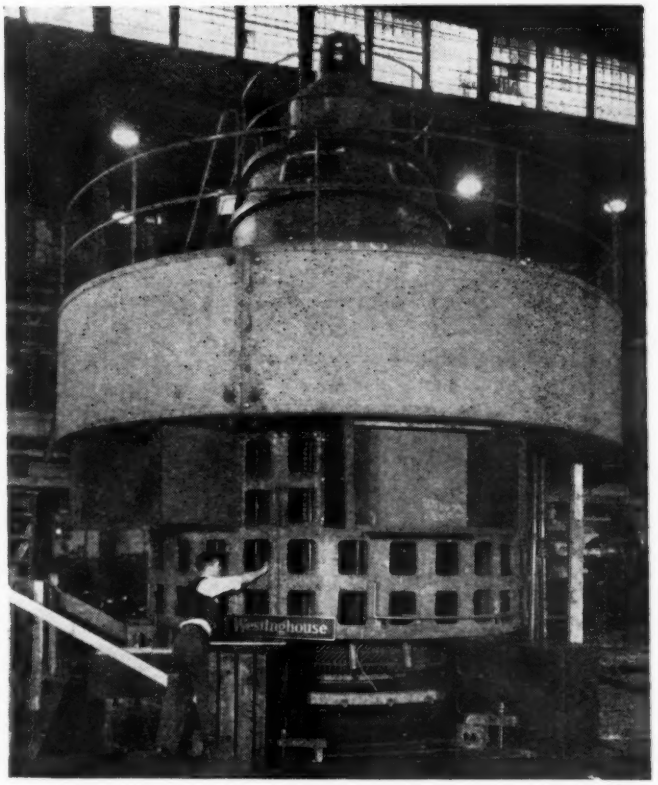



Fig. 6—Specimens show results of testing four oils for their rust-preventive properties. The first specimen, which is shown at A, gives the test results of a conventional uninhibited oil, while the last at D, which is free of rust spots, was tested in an oil that was completely rust-inhibited

# Power Development Features Mexico's Industrial Program

***Delegation representing Comision Federal de Electricidad purchases $25,000,000 worth of U. S. electrical equipment for planned expansion of the power system totaling 325,000 kw***




Waterwheel generator for Ixtapantongo project near Mexico City photographed in Westinghouse shops before shipment

► NEW YORK (*McGraw-Hill World News*): The importance of power in the projected industrialization of Mexico finds confirmation in the recent purchase in this country of $25,000,000 worth of electrical equipment, of which $10,000,000 went for generating machinery and $15,000,000 for cable, switchgear, transformers, lightning arresters, unit substations and similar equipment. The purchases were made by a delegation representing the Comision Federal de Electricidad, which is headed by the Minister of Economic Affairs and directs the Mexican electrification program. Carlos Ramirez Ulloa, a director of the Comision, headed the purchasing group's activities in this country.

### *Emphasis on Small Cities*

Present emphasis in the plan for expanding power generation and utilization under the nonprofit governmental Comision, rests on the electrification of small and medium-sized towns. Private interests largely handled the development of power supply for the major cities; rural electrification is yet to come. Figures in the table below show progress made up to the war years and the extent of the program for the immediate future. Of the independent companies, only Mexican Light & Power is expanding, constructing a 35,000-kw extension at Mexico City's 55,000-kw Nonoalco steam-power plant.

| *System* | *Beginning of 1944* | *End of 1947* |
|---|---|---|
| Mexican Light & Power.... | 330,000 | 355,000 |
| Comision Federal de Electricidad ..... | 100,000 | 336,000 |
| Conchos Co, Torreon..... | 51,000 | 51,000 |
| Chapala Co, Guadalajara*... | 34,000 | 98,000 |
| Puebla & Veracruz Co..... | 31,000 | 31,000 |
| Guanajato & Michoacan Co. | 18,000 | 18,000 |
| Other power companies..... | 86,000 | 86,000 |
| | 650,000 | 975,000 |

* Owned by Comision.

Perhaps best known of the Comision's projects is Ixtapantongo, first and major step in development of the waterpower resources of the Valle del Bravo basin. In this area, three plants will ultimately produce 175,000 kw, with Ixtapantongo designed for 85,000 kw. This plant, about 70 miles from Mexico City, is now operating with one 28,000-kw unit. Another is being installed, and a third will be set up in the future.

The waterwheel of the first unit at Ixtapantongo is one of the highest power high-head reaction turbines in the world and the first of its kind to be built in the U. S. Manufactured by Baldwin-Southwark, it is designed to deliver 39,000 hp at 600 rpm with 89% efficiency. Use of a reaction turbine with characteristic high speed permitted great savings in space, weight, transportation cost and installation time. The generator was supplied by Westinghouse and was essentially a duplicate of a 35,000-kva 600-rpm generator built for use with a waterwheel of European manufacture in a Brazilian plant.

Other plants in the Valle del Bravo basin will be Durazno (about 25,000 kw) and Santa Barbara. Earthworks for the latter have been begun and two units, totaling 46,000 kw, ordered. The Allis-Chalmers turbines will operate at 850-ft head to drive the Westinghouse generators.

Other major additions are to be made on the Chapala Co system, owned and operated by the Comision. Hydraulic works for a 10,000-kw extension to the existing Guadalajara plant on the Santiago River have been started. At Colimilla, also on the Santiago near Guadalajara, work on tunnels for a 54,000-kw installation goes forward and specifications for two of four power units have been given to U. S. equipment manufacturers.

At El Encanto, hydraulic work is complete and ready for the Allis-Chalmers equipment. It is hoped that half of the 20,000-kw installation will be in operation by July of this year. The entire plant is located underground in a cave. Connected with the plant at El Encanto

is the plant at Minas, Veracruz, which will consist of two 4800-kw installations, with turbines by S Morgan Smith and generators by General Electric. Practically completed, the plant at Valsequillo, Puebla, is also to be linked to the Minas-El Encanto system, but will serve principally for irrigation. The equipment consists of two 5500-kw units, turbines by Baldwin-Southwark and generators by Allis-Chalmers.

Other hydroelectric installations of interest include the extension at Zumpimito, near Uruapan, Michoacan, which is close enough to the new volcano Paricutin to experience trouble from lava and ash plugging intakes. Now powered by a single 1000-kw unit, this plant is getting another, and two more are on order; turbines from Leffel and generators from Westinghouse. The Tonilita, Jalisco, project has been expanded and will comprise two 4000-kw units, with turbines by Leffel and generators by General Electric.

Bombana, Chiapas, has just received from S Morgan Smith and Westinghouse two 1300-kw turbine-generators and two more will be installed in the future. Colotlipa, Guerrero, the plant for the resort town of Acapulco, has received one 2000-kw unit, with another being built by Leffel and Allis-Chalmers, and two more planned. At Cola de Caballo near Monterrey a 1000-kw unit is being built.

### *Steam-Plant Program*

All Mexico's power plans do not center in hydro development for, although the hydro potential is large (about 7,500,000 kw), distance from industrial centers makes some of it uneconomical to develop immediately. Steam plants and diesel units will thus play an important role in the Comision's program. The 13,000-kw plant at Veracruz, built of second-hand U. S. equipment, is now being tested. At La Laguna, in the Torreon district, two 12,500-kw Westinghouse turbine-generators have been received along with Combustion Engineering oil-burning boilers. This plant links with the hydro plant under development at Palmito, about 100 miles away, where three 10,000-kw units are to be installed. These plants are located in a rich agricultural and industrial district. Much of the energy will be used for pumping and irrigation, to power textile mills, oil presses and soap factories, and to refine copper and silver.

The Export-Import Bank has granted a loan of $20,000,000 to Mexico for the purchase of equipment and services in the U. S. The loan may be used up to June 30, 1948, carries 4% interest, and will be repaid in 104 approximately equal semi-annual installments.

# The Future of Nuclear Power

***From a paper presented before the ASME, New York, January 30. "It is only a question of time before we shall have an industrial technology of nuclear energy which can pay its own way."***

► I HAVE JUST RETURNED this afternoon from the atomic-energy plant of the Hanford Engineer Works, near Hanford, Wash., on the bank of the beautiful blue Columbia River, about halfway between the Grand Coulee and Bonneville dams. One could not ask for a quieter, smoother-running or more reliable plant. Having followed the project from the start-up in September 1944 I can say that the possibility of the controlled release of atomic energy does not have to be proved—it is an accomplished fact.

The Hanford plant was not built to generate nuclear energy, however. Its purpose was to synthesize a new chemical substance—plutonium, element 94—to make atomic bombs. The production of heat in this reaction was not merely incidental; it was a positive drawback in the program to make as much plutonium as possible. For example, the production of as much as one kilogram of plutonium per day requires the release of an amount of heat between one-half million kilowatts and one and a half million. From this figure you will understand that problems of heat transfer and heat dissipation controlled the capacity of the Hanford plant to synthesize plutonium.

In the nuclear energy plant of the future the liberation of energy will be the primary objective, and the production of plutonium or other substances subject to nuclear fission secondary. But the most difficult problems will still concern engineering: (1) to transfer heat from the chain-reacting structure, the so-called "pile," to a cooling fluid (2) to convert this heat into usable energy. The problems of nuclear physics, which enter into the design of the power-producing pile of the future, have in principle been solved.

### *Atomic Power to Pay Its Way*

Industrial men and scientists who have been connected with the uranium project, assuming freedom to develop, agree that it is only a question of time before we shall have an industrial technology of nuclear energy which will pay its own way.

Nuclear physics tells us that the power pile of the future will be in six important ways quite similar to the present Hanford piles.

**Only 34 years old, Dr Wheeler has already won world recognition for his part in the development of atomic energy. He assisted in the design and development of the plutonium plant at Hanford, Wash., and has been advisor to the operators since September, 1944**

By JOHN ARCHIBALD WHEELER
*Associate Professor of Physics*
*Princeton University*

First, the heat-releasing reaction will be fission, the division of a heavy atomic nucleus into two parts of approximately equal mass. Second, we will require as the source of energy a substance that undergoes fission with high probability when struck by a neutron. Only a few nuclear species satisfy this condition. In atomic weight they are all comparable to uranium, or heavier. The two most prominent examples are plutonium-239, the most important variety of the new and 94th chemical element; and Uranium-235, the variety of nucleus present to one part in 140 in ordinary uranium.

Both nuclear species play an important part in the Hanford piles. The U-235 undergoes fission and thus maintains the nuclear chain reaction. Most of the extra neutrons not needed to carry on the chain reaction synthesize the new fissionable element, plutonium. The pile of the future must operate by fission of one or other of these two substances, or of some nuclear species very near to these two in the periodic system of the elements.

Unfortunately none of the desired fissionable species of nuclei, except U-235, exists in nature in anything but insignificant traces. Furthermore, because the task of separating U-235 from ordinary uranium is difficult and expensive, it is reasonable to ask of the pile of the future a third feature: that it should synthesize, by a suitable side reaction, as much as possible of the fissionable material burned up during operation.

Here again the Hanford piles point the way. At the same time that their operation burns up the one fissionable material, U-235, it creates the new and equally desirable fissionable species, Pu-239. In partial explanation let me say that the process of synthesis starts with the very abundant but otherwise useless nuclear species, U-238. This species, by capture of a neutron and a resultant sequence of changes, is transformed into the wanted Pu-239.

In future attempts to accomplish this regeneration process, there will be one or other of two possible outcomes. It may be that each operating day of the pile of the future will burn up, let us say, one kilogram of the original fissionable material and regenerate out of U-238, or similar inert material, possibly only 0.9 kilograms of new fissionable material, such as plutonium. In this case the plant can continue operation only if we supply from outside each day 0.1 kilogram of new fissionable material. This requirement will prevent atomic energy from becoming quite as cheap as we should like to have it.

### *Self-Regenerating Pile*

The other possible outcome is more favorable to economy of raw materials. In every day of operation in which we destroy one kilogram of fissionable material, we will synthesize from an inert substance more than one kilogram of new fissionable material, say for example, 1.1 kilograms. In this case we leave 1 kilogram of the new product in the plant to make up for the losses of the day and remove the other 0.1 kilogram to help start up a new pile; or, if necessary, to help make atomic bombs.

If we achieve this outcome, there will

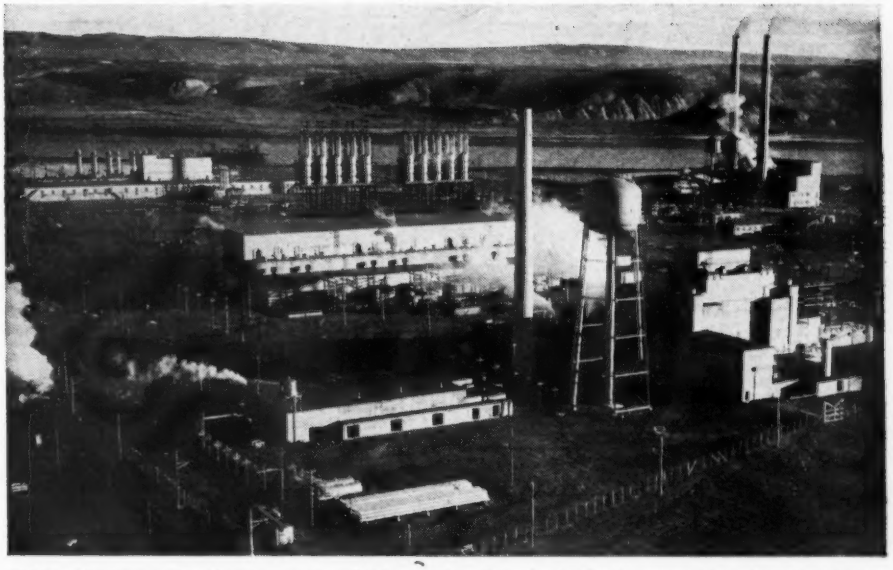
be no need for us to supply new fissionable material to our plant from the outside except to get it started. After it is in operation we could even feed it, as raw material, uranium from which all of the active constituent, U-235, had been extracted, although it would be cheaper to use natural uranium. The plant itself will convert the inactive uranium to fissionable material for use in the chain-reaction. Evidently we have only to design a plant with sufficiently good regeneration characteristics to use for power purposes *all* the uranium, not merely the rare constituent, U-235.

In the future, as in the past, it will be necessary to use for raw material either uranium itself or possibly (we may hope) some other element of comparable abundance on the earth, but with a neighboring or higher position in the periodic table of the elements. The only such substance that exists in nature is thorium, an element apparently somewhat more abundant than uranium. Consequently the pile of the future will be expected to use as source of energy either uranium or, possibly, thorium.

### *Chemical Treatment Necessary*

There is a fifth requirement on the nuclear power plant of the future. Associated with the power unit there should be a chemical plant for the treatment of both the raw material and the fissionable materials after they have been exposed in the pile. As time goes on fissionable material will be synthesized within the relatively inert raw material. If this fissionable substance is allowed to stay where it is, it will eventually be struck by a neutron and be caused to split, but to split at a point in the pile where the neutrons which it gives off will not be used with full effectiveness. To avoid this loss of efficiency, which might be serious, we must expect to have to withdraw the raw material periodically from the unit and abstract from it the newly synthesized element. The two components that result from this chemical separation process will then be sent back to their proper places in the pile, the raw material to one location, and the fissionable to another.

The fissionable material will also experience changes calling for its reprocessing. The products of nuclear fission, elements of medium atomic weight like barium, lanthanum, xenon, rubidium, selenium, tellurium, silver and ruthenium, will accumulate and poison the chain-reaction by absorbing the neutrons that we want for more productive purposes. Consequently we will expect to have to remove these byproducts of the reaction from time to time from the fissionable material, whether this material is U-235, Pu-239 or something else.



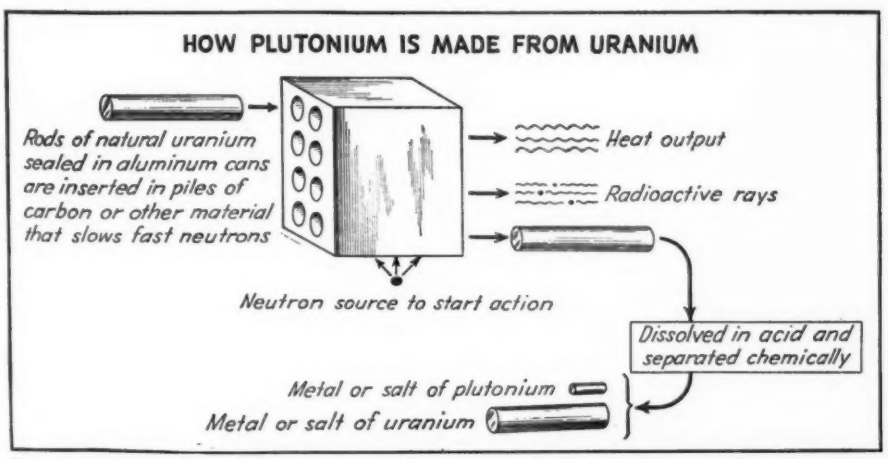
**This photograph shows part of the extensive installations at Hanford, Wash., for the production of plutonium for the atomic bomb. Plutonium is element 94.**

Of course the separation plant of the Hanford pile does only a part of what we demand of the separation plant of the future. It withdraws from the working material only the plutonium that is required for atomic bombs. It is designed to produce plutonium by the most straightforward means possible, with no attempt to serve as a power plant. Consequently it does not need to prepare the working material, uranium, for reintroduction into the unit.

Sixth and last major point of resemblance between the future plant and the Hanford pile is the requirement of protection of human beings from radioactive radiations. The so-called gamma rays, together with the neutrons coming from a pile in full production, have near such a reactor an intensity more than a million times as great as can be tolerated by the human organism. It is necessary to surround the pile with a shield that will cut down the intensity of these radiations to a negligible level.

### *Heavy Shielding Needed*

You can imagine the difficulties that arise in obtaining complete protection when you consider that there must be openings in the shield for the entrance and discharge of the cooling fluid and for the insertion and removal of uranium or other working material before and after irradiation. I am glad to say that


HOW PLUTONIUM IS MADE FROM URANIUM
Rods of natural uranium sealed in aluminum cans are inserted in piles of carbon or other material that slows fast neutrons
Heat output
Radioactive rays
Neutron source to start action
Dissolved in acid and separated chemically
Metal or salt of plutonium
Metal or salt of uranium

**In the piles at Hanford spare neutrons from U-235 nuclei, splitting in chain reaction, convert U-238 atoms into the new element plutonium, which in turn can give off energy by atom splitting. When the pile is operated for production and extraction of plutonium for bombs, heat of reaction is wasted to the Columbia River. This heat could easily be harnessed to generate power by steam turbines. Diagram based on sketch in Sept 1945 numbers of all McGraw-Hill publications**

these structural problems have been solved at the Columbia River plant, and solved in a very satisfactory way.

Even for a unit generating as little as a 100 kw the required shielding has a thickness of a number of feet and weight of the order of 50 tons. The principles of shielding are very simple and straightforward. What counts is essentially the product of the thickness and the density of the protective material.

It might just be possible to carry an adequate shield through existing railway tunnels on a locomotive driven by nuclear power, but the prospects for train propulsion are not bright. Atomic power appears to be quite out of the picture for automobiles. The same conclusion applies to airplanes, at least until their weight-carrying capacity reaches a figure ten to a hundred times its present one.

On the other hand, it is quite in order to count on nuclear energy for driving ships, or for running a stationary electric power plant. In neither application does a heavy shield cause too much difficulty. And, fortunately, the required weight of the protective material does not increase greatly with power level.

The magnitude of even a single atomic power plant is necessarily so great that it may possibly not be economically feasible below 100,000-kw capacity.

### *Future Heat-Transfer Fluids*

In the Hanford piles the cooling fluid is water; in the future power plant this fluid will be some substance capable of going to much higher temperatures than water without requiring very high pressures. High pressures would require heavy piping; but every foreign material introduced into the pile absorbs neutrons and makes it that much more difficult to run the unit efficiently.

In contrast to the pressure, the temperature of the pile is a matter of relative indifference from the point of view of the nuclear chain reaction. It will therefore be reasonable to operate at as high a temperature as our materials of construction will stand, and gain all the thermodynamical efficiency that we can in our power plant. The cooling fluid, whatever it is, will then be led out to a heat exchanger. There its energy will be turned over to water or mercury or some other substance capable of driving a turbine or other prime mover. That is the power plant of the future.

# SHORT CUTS TO PLANT EFFICIENCY

## No. 3—Some Rules for Boiler Efficiency

By W A SHOUDY
*Consulting Engineer*

***Last month Mr Shoudy analyzed three historic boiler tests. Here are summed up certain conclusions regarding the right way to design and operate boilers for good results.***

▶ THE TESTS discussed in the February issue of POWER, pages 91-93, show that if a steam-generating unit is clean, and in good repair, maximum efficiency can be maintained by watching just these two items:

1. Leave as little carbon in the ash as possible without increasing excess air. It is easy to watch the color of the ash pile. An occasional analysis of the ash for carbon will help.

2. Operate with the minimum excess air that the furnace permits without formation of CO. Each furnace has its own limitations. A series of careful flue-gas analyses should be made of both CO and $CO_2$. When the highest $CO_2$ has been found without CO use that percentage as a guide and *do not exceed it.* Good automatic combustion control pays for itself quickly because it controls the excess air. The service engineer determines CO as well as $CO_2$ and sets the apparatus accordingly.

These three heat balances show how we may select a steam-generating unit and point to three basic rules.

1. Select the most efficient furnace that can burn the maximum weight of fuel required to carry the maximum load. This means not only selecting the correct burner or stoker but also carefully selecting size and shape of furnace so that combustion may be complete before gas enters the boiler tubes. It is well to base capacity estimates on the worst fuel that may reach the plant, but base the efficiency estimates on the regular supply of fuel.

2. If natural draft must be used select as large a boiler as can be obtained with a maximum draft loss suitable to the chimney.

3. If natural draft cannot be used, or higher efficiency is desired, install a boiler with an economizer or air heater, or both, of such size that the final exit-gas temperature is about 375 F at normal load. If there are long operating periods at very low loads it is well to set this temperature 25 or 50 F higher to avoid low temperatures that may cause corrosion at low loads. It is unnecessary to discuss efficiency. Fuel analysis, furnace design and exit temperature determine it.

3a. Use an economizer if high-temperature air causes trouble in the furnace or if feedwater does not leave a deposit in the tubes.

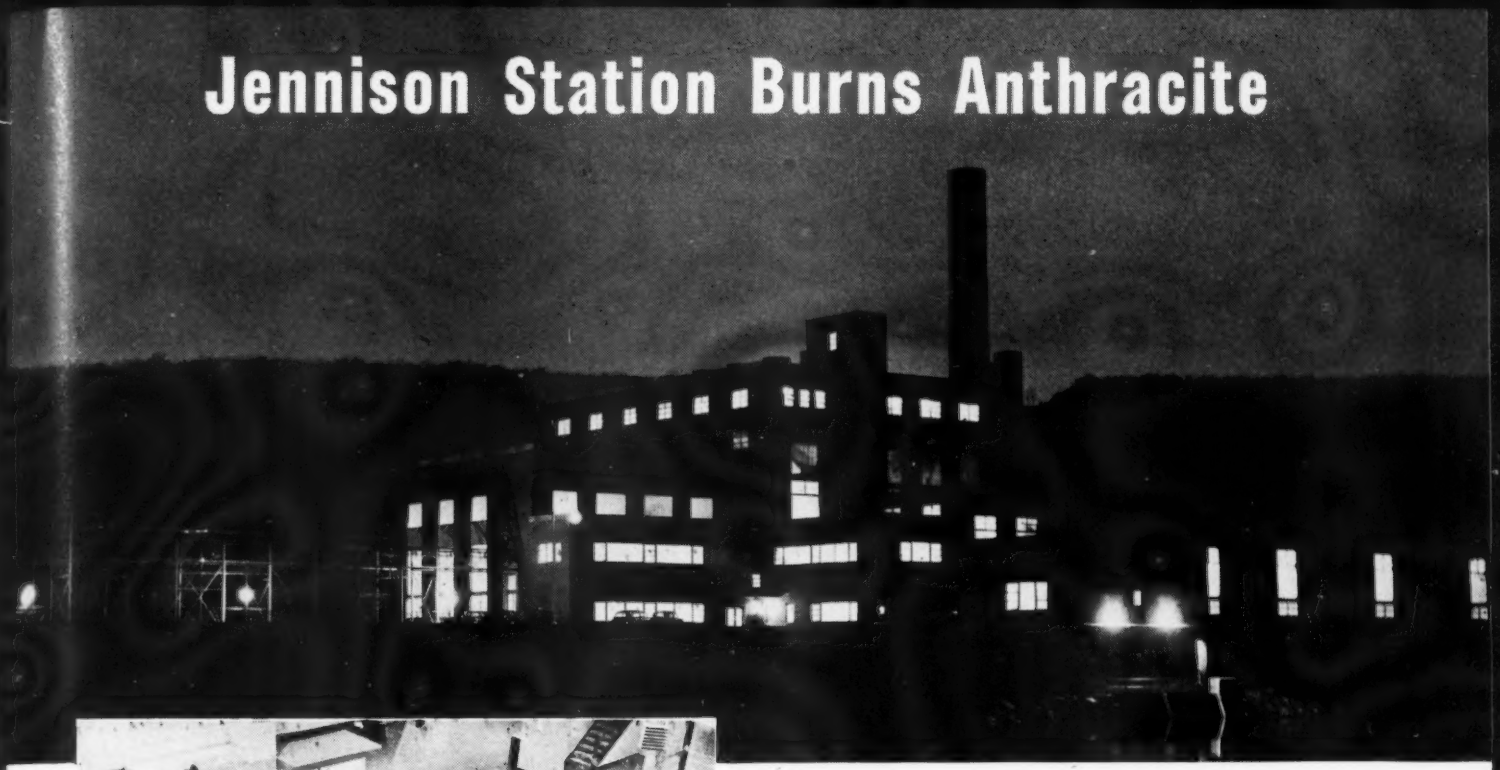
3b. Use an air heater when high-temperature air can be used in the furnace—also for pressures above 450 psi and if feedwater may cause trouble.

3c. Use both economizer and air heater for special conditions such as limited building space, or to give a limited amount of air preheat.

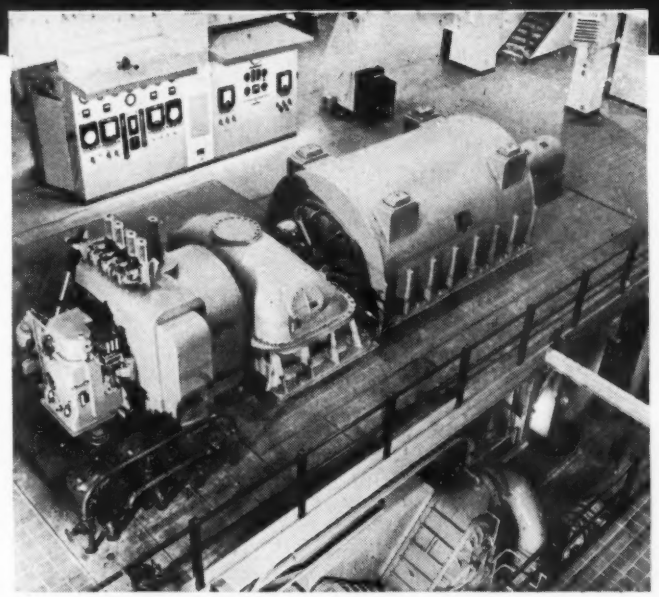
Relative sizes of boiler, economizer and air surface will be determined by the suitability to the furnace and by what is the cheapest combination of surfaces. Since the furnaces and the exit-gas temperature will be the same, the unit efficiency *must* be the same for all combinations of surfaces. Because the draft resistance in the economizer or air heater is higher than in the boiler each combination will have a different total draft loss. Limit to the draft loss is determined by the cost of power to drive the fans.

What performance then should we ask a manufacturer to guarantee? Only the following: carbon loss, excess air at entrance to the tubes, excess air and gas temperature leaving the unit, forced-draft pressure, draft loss and capacity. It is convenient for a purchaser if the unit efficiency is stated but a heat balance must be included to determine whether all competitors are estimating on the same basis. Otherwise the efficiency guarantees are misleading.

# Jennison Station Burns Anthracite



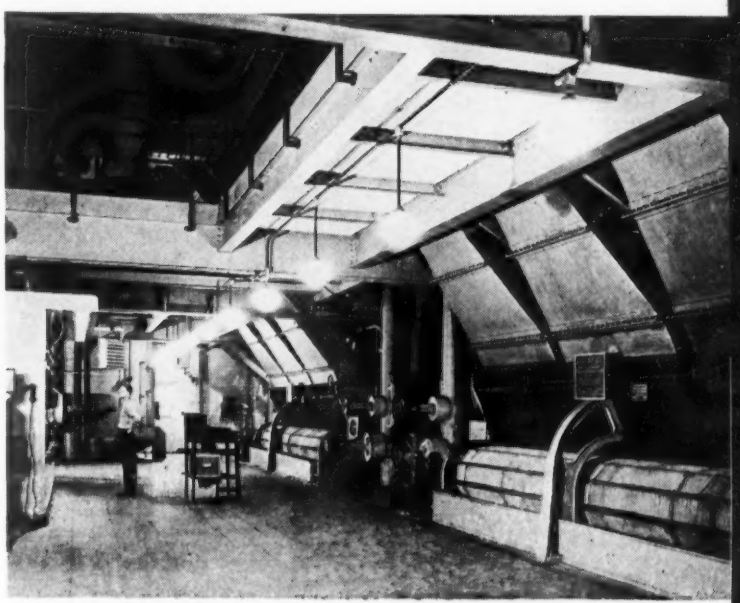
Completed within 17 months of initial ground breaking the new Jennison Station began operating during October 1945



30,000-kw 650-psig 825-F 4-point-bleed turbine drives hydrogen-cooled 13,800-v electrical generator at 3600 rpm

▶ Located in Bainbridge, New York, the new Jennison Station of the New York State Electric & Gas Corp was formally dedicated in honor of the company's president, Ralph D Jennison, on December 13, 1945. Consisting of two steam generators feeding a single turbine-generator this plant will burn No. 4 buckwheat anthracite brought from a mine only 65 miles away. Features are largest traveling-grate stokers of the particular design; slow-speed fans driven through electronic couplings by motors; "boat" type foundation eliminating need of piling; furnace and ash pit designed to permit future installation of underfeed stokers, if desired; economizer, air heater and i-d fan protected from anthracite-cinder erosion by having the cinder-catcher precede them.

Ralph D Jennison, president of New York State Electric & Gas Corporation, at dedication tablet mounted in station



Two 200,000-lb-per-hr steam generators fired by 24x28-ft traveling-grate stokers supply the main h-p steam turbine

# Riley Side Dump Stokers

## Reduce Coal Bills

**Because of their efficient operation, Riley Side Dump Stokers reduce coal bills not only by burning less coal but because of their ability to burn low priced coals.**

"We have been able to reduce our coal bill 33⅓%."
—Brown Shoe Co., Moberly, Mo.

## Burn Cheaper Coal

**Not only do fuel savings result from being able to burn cheaper coals but in time of emergencies, you can maintain your steam load with poor grades of coal.**

"With this type of stoker you are able to use a much cheaper grade of coal."
—Palace Laundry Co., Niagara Falls, N. Y.

## Eliminate Smoke

**The use of the underfeed principle of combustion and the proper application of the stoker with reference to boiler eliminates smoke.**

"We have no trouble with smoke while with hand firing we were always in bad with the smoke inspector."
—Y.W.C.A., Indianapolis, Ind.

## Maintain Constant Pressure

**Because coal feed and air supply are automatically regulated, uniform steam pressure is maintained.**

"We are able also to carry an even steam pressure, while our load is very much fluctuating."
—United Dairy Co., Wheeling, W.Va.

1 Main Cylinder
2 Ram Case
3 Coal Hopper
4 Tuyere Blocks
5 Pusher Block
6 Retort
7 Air Control Damper
8 Combustion Grates
9 Dump Plates
10 Side Beam
11 Ash Pit
12 Air Chamber

TRADE MARK Rx REGISTERED

# RILEY

**STOKER CORPORATION, WORCESTER, MASS.**

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

**It will pay you to visit modern Riley Installations**

# ...a profitable investment

## Save Labor

**Due to its automatic and mechanical action, labor is saved and labor turnover is reduced.**

"We were having trouble in keeping firemen. The stokers made the firemen's task so much easier that we have no labor difficulties now."

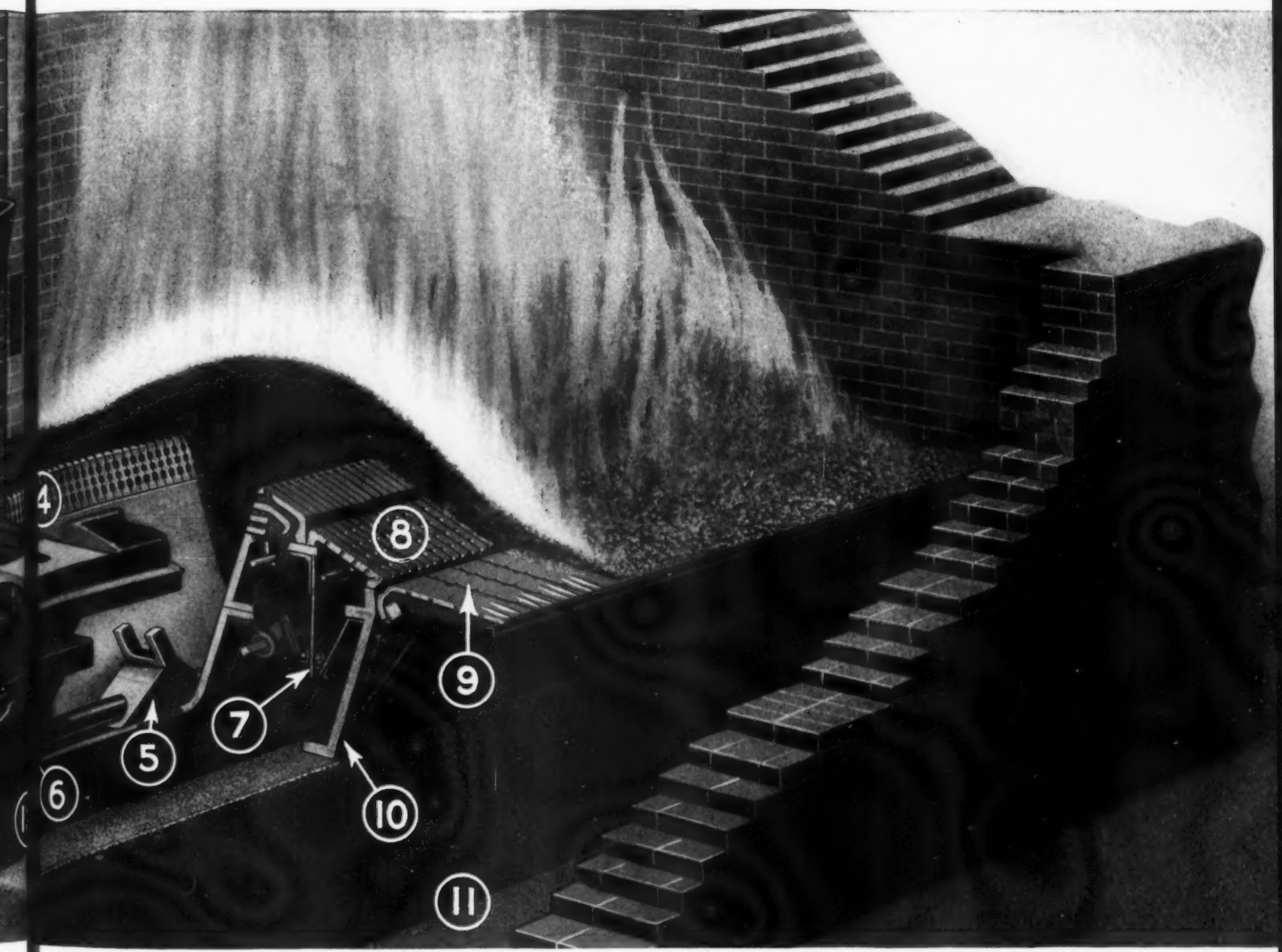
—Lewis Manufacturing Co., Walpole, Mass.

## Increase Steam Output

**Because of their ability to efficiently and completely burn greater quantities of coal, steam capacity of boilers is increased.**

"We are able to carry the entire peak load with one boiler, whereas two boilers were always required when firing by hand."

—Mishawaka, Ind., Water & Electric Plant

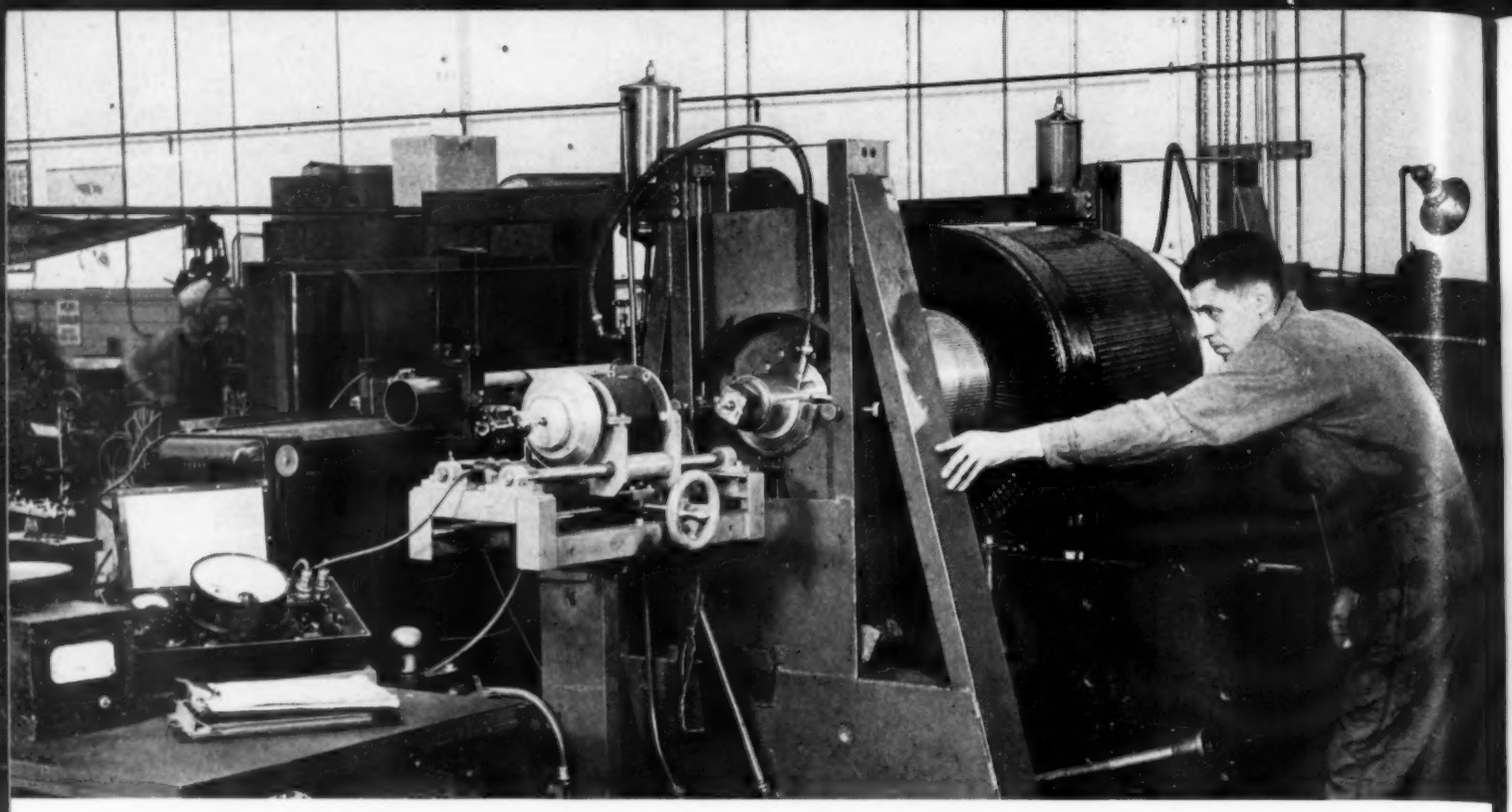



*A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs*

# COMPLETE STEAM GENERATING UNITS

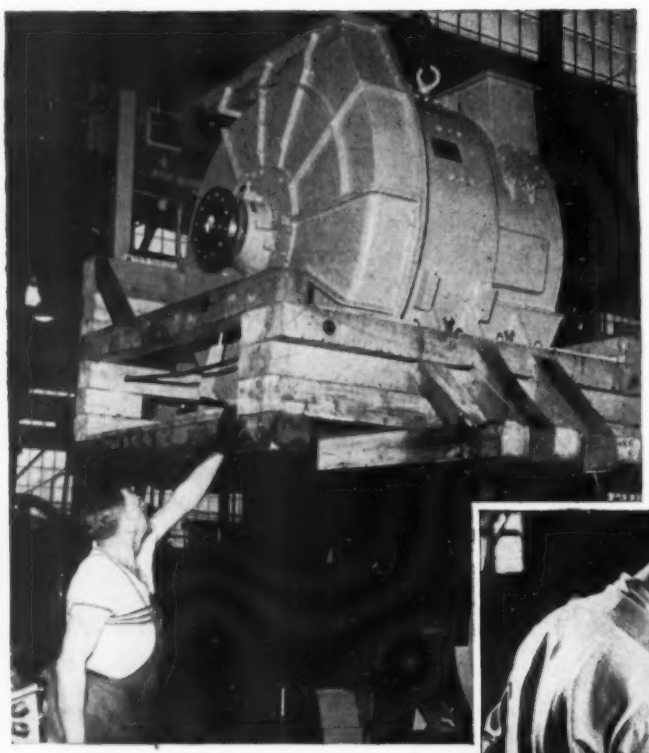
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

**before purchasing Boiler or Fuel Burning Equipment**



Balancing operations for armature of 1375-hp dc motor need dynamic-balancing machine whose delicate devices detect unbalance to 1/27 oz in 10,000 lb. Such checks are but one step in fitting electrical components for submarine duties

# Service Station for Ailing Submarines



Completely rebuilt 10-ton 1100-kw generator (above) leaving assembly and final-test floor for installation aboard. Right: Reaming dowel-pin holes in coupling flange on shaft of diesel-driven 1100-kw generator. Such holes must meet a stated tolerance of 2/10,000-in.

► THE EMERYVILLE, CALIF., PLANT of Westinghouse kept its repair department active in rebuilding and repairing electrical equipment for submarines on patrol assignments in Pacific and Japanese waters. Throughout the war over 75 submarines underwent electrical servicing for commonly carried gear of all kinds. Motors, generators and controls were completely dismantled and rebuilt.

Small 2-hp compressors as well as some 150 8-ton 1375-hp dc main-drive motors and more than that number of 1100-kw 10-ton generators were repaired. Program's height was marked by receipt of electrical equipment at a rate of one submarine per week. Over-all repair period ran to 21 days for each set of equipment although the 125 men averaged repairs enough each week to outfit one submarine. Schedule ran to steady 3-shift operation to recondition equipment for sudden, heavy demands its duty imposed. The personnel are justifiably proud of their close association with an important service.

# THE PRESIDENT'S WAGE-PRICE POLICY WON'T WORK

THE AMERICAN public had every right to expect that the long-awaited wage and price policy would break the impasse blocking the way to the swift and orderly reconversion of industry from war to peace.

The policy announced offers little promise of such solution, and this may well constitute a national calamity.

There is only one thoroughly constructive feature of the Presidential Statement of February 14 and its implementing Executive Order. It is the first Government pronouncement since the defeat of Japan to clearly define inflation as the major danger confronting us in the period immediately ahead.

That is a correct appraisal, and one long overdue. Up to now Government spokesmen, almost invariably, have sought to carry water on both shoulders. The Administration has justified its policy of promoting wage increases as a measure necessary to forestall deflation — to keep purchasing power from falling and forcing the economy into a violent tailspin. The strict holding-of-the-line on price ceilings has been defended as necessary to prevent runaway inflation. Unfortunately, while the President now exhorts all to enlist in a crusade against inflation with a voice that is clearly Jacob's, his program for dealing with it still employs the hairy hands of Esau to promote the very danger which he is urging everyone else to combat.

The "new" policy provides for a continuation of the wage increases that have been pressured through by Government mediators, "fact-finding" boards, and direct seizures until they have been made general throughout industry upon the dimension established in recent patterns. It offers industry the single concession of prompt hearings and decisions upon claims for price advances, but the yardsticks for judging such claims are exactly those which OPA has applied in the past. Since the past procedure has led us into our present difficulties, it is hard to see how it will serve now to lead us out of them.

### Past Government Policy Fostered Dissension

At the war's end, it was obvious to everyone that what was needed was the swiftest possible reconversion of industry. It should have been equally apparent that we were faced with the difficult problem of controlling tremendous inflationary pressures which would be particularly insistent until peacetime production could be mobilized at high volume. This was made almost inevitable by the huge backlog of accumulated demand, for both capital and consumer goods, and by the unprecedented volume of liquid funds at the disposal of individuals of all classes. The only circumstance that could have modified the inflationary complexion of the postwar picture was the possibility of such wholesale and prolonged dislocation and unemployment in the process of readjustment that people would have been frightened into freezing onto their savings instead of spending them.

It soon was apparent that just the opposite was taking place. The early transition was extraordinarily swift, unemployment was lower than anyone had dared hope, and civilian spending outstripped all previous records. The circumstances called for strong anti-inflationary fiscal measures, along with a firm maintenance of price and wage controls alike.

Instead of adopting such a balanced program, the Government immediately discarded all wage controls, and in addition started an active campaign for promoting large wage increases. The President, upon a number of occasions stated flatly that American industry generally could and should grant substantial pay advances without any compensating price rises. His Office of War Mobilization and Reconversion estimated that average increases were practicable to the extent of 24 per cent. Given such Governmental encouragement, it was inevitable that labor leaders should do exactly what they did—file extravagant wage demands at the beginning of the reconversion process, when accurate appraisal of production schedules and costs were least susceptible of calculation, and when the shortage of civilian goods multiplied the inflationary effect of any increase in purchasing power.

At the same time, the OPA was fighting to hold the price line in a good cause, but with singularly inept procedure. It acted, seemingly, upon the premise that it was always better to give less price relief than was needed rather than enough, that relief provided under its formula was preferably to be granted later rather than on time, and that the interests of lower-bracket income receivers should be protected by a particularly tough resistance to raising prices of cheaper goods. The latter procedure seems to have boomeranged by virtually driving many of the lower-priced lines off the market.

The sum of these wage-price procedures resulted in work-stoppages of epidemic scope. Many business concerns faced with the prospect of immediately unprofitable operation, uncertain that new wage demands would not be made with Government support as soon as volume production was established, and without assurance as to when price controls would end, refused to assume inevitable losses even when confronted with combined union and Government pressure. The fight was on.

### "New" Policy Differs Little From Old

With inflation now clearly recognized as the immediate danger, it might have been expected that the new wage policy would reverse the former practise of lending active encouragement to new wage advances. But that would have brought down upon the Administration the wrath of all organized workers who had not yet been granted increases already bargained through by other groups. This was avoided by directing the National Wage Stabilization Board in effect to approve any wage increases necessary to give general advances comparable to those already made. The only brake applied on the wage side lies in a directive to the Board not to approve, as a basis

for price relief, wage advances that go beyond the established pattern.

On the price side, the new directives to the OPA entail no important departure from its past procedures. Even the concession to review "hardship" cases promptly rather than after six months is only a pious hope, since it is unlikely that OPA is equipped to deal rapidly with the thousands of cases that will arise. A hardship case is defined as one in which, after absorbing an approved wage advance, an industry or establishment in a twelve months' period of normal-rate operation is judged by the Price Administrator likely to operate at a rate of profits to net worth less than it averaged in the base period of 1936-1939.

Let us see what this really means. In the first place, the rate of manufacturing profits in the base period was only moderate. But since the average net worth of manufacturing corporations has increased one-third over what it was in the base period, the application of the OPA formula, *assuming that its Administrator correctly appraises the twelve-month outlook,* seems to provide for absolute profits one-third higher than the 1936-1939 average.

The OPA formula, however, applies to profits *before taxes.* What really matters to stockholders is profits *after taxes.* Corporation taxes have been increased from an average of 17 per cent in the base period to 38 per cent now. This means that the price adjustments granted by OPA on average will yield profits *after taxes* no larger in dollar terms than in the 1936-1939 period, although 1946 manufacturing sales are expected to be more than twice as high. Under this procedure the *ratio* to net worth of profits *after taxes* will be one-fourth lower than the 1936-39 average. This clearly undermines the incentives upon which production at high level depends.

The workers get wage increases which promote inflation. The Government, bailed out from its previous mistakes, gets political credit for raising wages. And the entire bill is handed to American industry for payment.

## But the Danger of Inflation is Real

Under these circumstances, there is a growing demand on the part of business groups that price controls be rescinded immediately. It is argued that, once the restrictive influence of price controls is relaxed, capacity production soon will supply sufficient goods to prevent undue price inflation.

It is understandable that business should wish to be rid of Government controls which have operated in such a thoroughly inconsistent and damaging fashion. Unfortunately, there is ground for believing that more harm might result from this cure than from the disease.

There is nothing in our situation that could bring on the kind of inflation that has been experienced by certain countries of Europe and Asia—in which the value of currency deteriorates until it takes a cartload to buy a pair of shoes. But our situation now is definitely more threatening than it was in 1919, after the first World War. At that time wholesale prices and the cost-of-living skyrocketed almost 25 per cent within twelve months. If we discard all controls now, as we did then, prices might easily go up from 25 to 50 per cent in a year's time.

An inflation of that dimension can do tremendous damage. While it lasts, all those dependent upon fixed incomes are damaged—all bondholders, including those who hold war bonds, all life insurance and annuity beneficiaries, all pensioners. Generally, the purchasing power of wages and salaries would shrink, with white collar and unorganized production workers hardest hit. Controlled-rate industries, such as railways and other utilities, would be squeezed. General business would suffer least of all—while the boom lasted.

But such soaring booms cannot last. The 1919 boom burst in mid-1920. By summer of 1921 industrial prices had fallen 40 per cent and industrial production was off 35 per cent; farm prices had fallen 50 per cent. This time the boom might soar higher and last longer, but that would merely result in an even more precipitous drop. Business would be hard hit along with everyone else, and high wage rates would mean nothing to the unemployed.

## Controls Must be Consistent and Progressively Relaxed

But if the Nation cannot afford to risk disastrous inflation by immediately abolishing controls, neither can business afford to accept the program which the Administration now proposes.

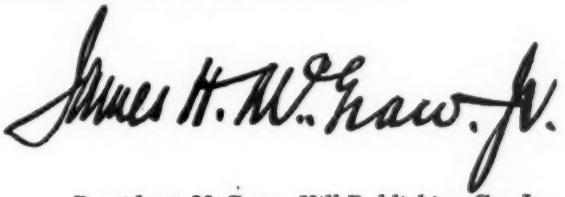
The wage-price policy will not hold the inflation line so long as the Administration is leading the assault to breach that line on the wage side, as it has done ever since VJ-Day.

The Administration is now going before Congress to ask for a broad extension of its wartime powers for an additional year beyond June, 1946.

Congress must see that this is not granted except upon terms that guarantee the use of such power with a consistency that has been conspicuously absent up to now.

1. It must provide sufficient price relief to yield profits normal to high-level operation.
2. The basis for price relief must be clearly defined and geared to actual costs of operation at the earliest possible date.
3. OPA administrative procedures must be speeded-up and streamlined, or the delays that characterized past administration will become intolerable.
4. It must see that, once established, the new line is held as long as wartime controls are continued by enforcing restrictions on wages as well as prices.
5. It must set an early date for the termination of all wartime controls and provide for progressive and bold steps for de-control to be taken before that date, as soon as production levels in any field are sufficiently high to restrain runaway prices.
6. It must proceed without delay to marshal fiscal and monetary policies to combat inflation, in order that price controls may be discarded at the earliest possible date.

Unless Congress does this—and it will not be easy in an election year—we are headed for an explosion. It will come in one of two forms—either in a continuance of industrial strife, or in a rocketing inflationary boom that can only end in collapse and depression.



*President, McGraw-Hill Publishing Co., Inc.*

# Electronics and Atomic Energy Explored at AIEE Convention

***Electrical engineers center attention on application of electronic excitation systems to large high-speed turbine-generators and experience with these systems; the development of atomic energy, its economic aspects and peacetime applications***

▶ WITH THE ENGINEERING SOCIETIES Building as headquarters, the American Institute of Electrical Engineers' winter convention hit its postwar stride. For five days crowded with activities, Jan 21 to 25, over 2000 members and guests attended 30 sessions at which 117 papers were presented. With an eye toward the future the technical sessions and conferences explored new frontiers of electrical engineering. Nuclear energy and electronics held top interest, nearly one half of the papers and addresses being on these subjects. Papers on excitation systems for ac generators and the addresses on nuclear energy are here summarized because of their particular interest to power engineers.

S B Crary and J B McClure, General Electric Co, outlined the problems involved in providing an excitation system for synchronous generators. After giving suggested definitions and performance specifications for these systems, they discussed their requirements. During the last ten years, the trend toward large-capacity high-speed steam turbine-generators has increased the use of separate exciters. These simplify the main-machine foundations, avoid high-speed commutators, and permit exciter maintenance without shutting down the main unit.

### *Electronic Exciters*

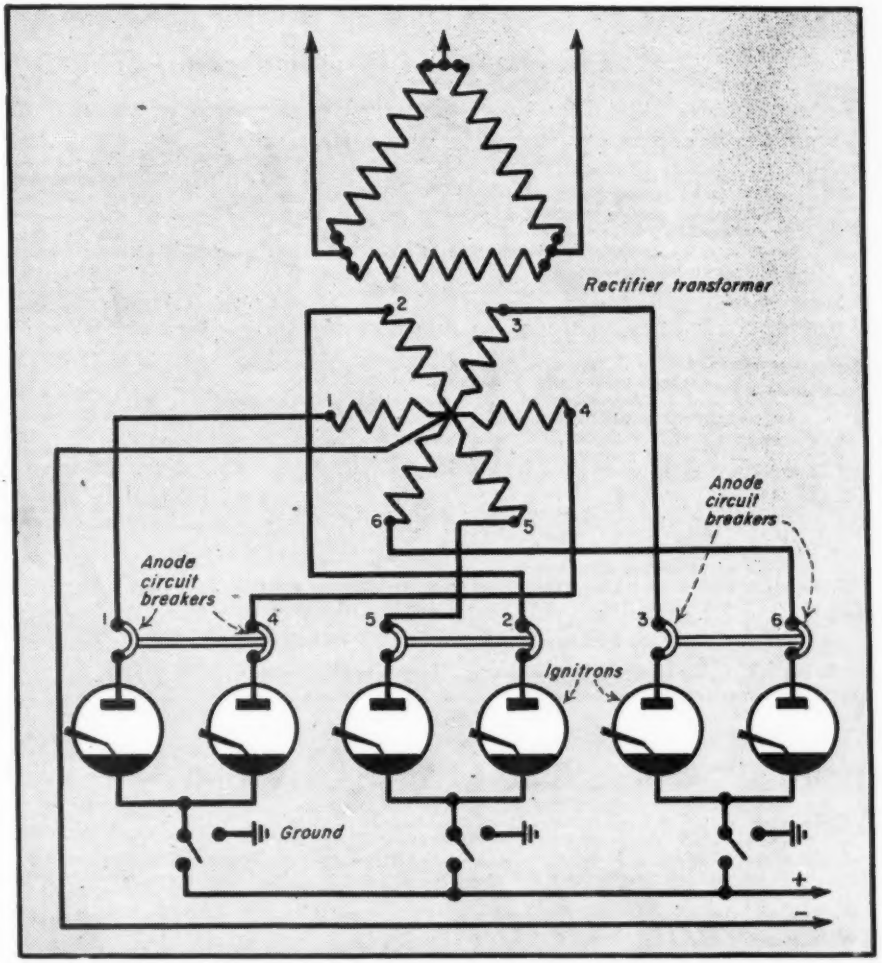
After discussing different methods of obtaining an excitation source, the authors expressed the opinion that the electronic exciter may provide another means for eliminating direct-connected exciters.

Electronic exciter units have been supplied for differing applications. Three large synchronous condensers using electronic exciters supplied by one manufacturer, operated for eleven, nine and seven years respectively, have given outstanding performance. They are equipped with water-cooled ignitron power tubes having ample capacity and arranged for changing the tubes while the set is in operation.

Initially, tube life did not measure up to expectation, but progress in the art has resulted in reasonable tube life. Based on present experience such an electronic exciter, supplied by a suitable transformer connected to the auxiliary power source in the station, has higher initial cost and maintenance than either the direct-connected or motor-driven exciter generator.

M D Ross, Westinghouse Electric Corp, reviewed and compared present and proposed excitation systems, classifying their features as in table (next page). He expressed the opinion that most turbine-generators built today are equipped with generator-shaft-driven exciters. Indications are that this type will continue to be popular because of its simplicity and low cost. Excitation systems with rotating-regulating exciters will continue to improve. The electronic exciter offers many advantages in high availability, which may make it a competitor of the rotating-regulating exciter in larger sizes.

Many structural and operating advantages of ignitron rectifiers for general industrial, mining and electrochemical dc power supply suggest their applica-




**Simplified circuit diagram of an electronic-rectifier excitation system for a 65,000 turbine-generator at the Springdale plant of the West Penn Power Company**

tion as a source of excitation for large generators.

W R Farley and C R Marcum, Westinghouse Elec Corp, gave design features of an electronic exciter for a 65,000-kw turbine-generator at the West Penn Power Co's Springdale plant. The diagram shows the simplified circuits of this electronic exciter. The delta 6-phase-star rectifier transformer is energized from the plant's auxiliary power supply. The rectifier comprises three groups of two ignitrons; each group connects through a 2-pole anode circuit breaker to diametrically opposite phases of the transformer. Common cathode of each group connects through a knife switch to the positive dc lead and the transformer-bank neutral connects to the negative dc lead.

Each pole of the anode circuit breaker has a reverse-current trip attachment to provide automatic tripping for the protection against arc backs. Opening of a breaker removes two ignitrons from service, which avoids transformer saturation and provides nearly balanced conditions during part-capacity operation. With an anode breaker open the four remaining ignitrons can supply sufficient dc voltage for full-load field excitation. With two ignitrons in service the rectifier can provide no-load field excitation continuously and full-load field excitation momentarily. Rectifier transformer voltage ratio is so selected that with all tubes in service and an auxiliary power voltage as low as 75% normal, the rectifier can supply the required field excitation under fault conditions. Tests show that operating characteristics of this exciter are as good as or better than those of other types. An early electronic exciter, similar to this one, but without many of its refinements, has not caused a shutdown in 3½ years of service.

Requirements of rectifiers when used to excite large ac generators, and results of tests to determine performance under various operating conditions, were presented by H A P Langstaff, West Penn Power Co; H R Vaughan and R F Lawrence, Westinghouse Electric Corp. Results cover preliminary tests on a laboratory model in addition to extensive tests on an electronic exciter now installed in the West Penn Power Co's Springdale generating station. This unit was designed to serve eventually as the main exciter for an 81,250-kva 3600-rpm turbine-generator just installed, but is now supplying excitation to a 47,100-kva 1800-rpm turbine-generator.

The following tests were recorded on oscillograms: 7 load changes, 14 arc backs, 22 sympathetic arc backs, one transfer of excitation, three generator voltage buildups—a total of 43 tests. In addition, a number were made without oscillographic records. From these tests and the authors' experience with this class of equipment, they arrive at the following conclusions:

1. Extensive laboratory tests based on pessimistic conditions that are unlikely to be met in service have demonstrated that an electronic exciter can be depended on as a reliable source of excitation for large ac generators.

2. The ac power supply best suited to the rectifier depends on the conditions.

3. If self-excited, the electronic exciter

# EXCITATION FOR LARGE TURBINE-GENERATORS

## *Advantages and Disadvantages of Eight Different Systems**

1. ***DIRECT-CONNECTED EXCITER WITH PILOT EXCITER***

   A. Lowest installed cost
   B. Not affected by system disturbances
   C. Unit requires no outside source of ac power to put it in service
   D. Uses exciter-rheostatic regulator
   E. Without a spare exciter, brushes must be changed under load for continuous operation
   F. Mechanical or commutation troubles cause a shutdown

2. ***DIRECT-CONNECTED EXCITER, NO PILOT EXCITER***

   A. Same as No. 1 except that it has no pilot exciter and main-exciter excitation is taken from a storage battery
   B. No mechanical problems involved. Battery-charging unit can be serviced at any time without interrupting excitation
   C. Works satisfactorily with exciter-rheostatic regulator
   D. Extra cost of larger battery charger is relatively small
   E. Station battery is more vulnerable to interruptions

3. ***SELF-EXCITED DIRECT-CONNECTED EXCITER***

   A. Same as No. 1 without pilot exciter; exciter energizes its field coils
   B. Not affected by system disturbances
   C. For generators up to 15,000 kva a direct-acting regulator is satisfactory. Above 15,000 kva, exciter-rheostatic regulator is difficult to design.
   D. Without spare exciter, brushes must be changed under load for continuous operation
   E. Unit requires no outside source of ac power to start it
   F. Mechanical or commutation troubles cause a shutdown

4. ***ROTATING-REGULATING EXCITER***

   A. Same as No. 1 without pilot exciter. Rotating-regulating exciter provided, in which a small control-energy source regulates output voltage of main exciter through special-control field winding
   B. Does not require a large rheostat for voltage control. Can be controlled by direct-acting regulator or static regulator
   C. Main exciter is larger than in No. 1 because the magnetic circuit must be designed for relatively low saturation
   D. Comments B, C, D and F of No. 1 apply here

5. ***DIRECT-CONNECTED HOUSE GENERATOR***

   A. Installed cost higher than for No. 1 because of extra exciter and control for house generator. House-generator cost is not all chargeable to excitation as it supplies power for other auxiliaries
   B. Not affected by system disturbances
   C. Without spare exciter, brushes of both main and auxiliary motor-generator must be changed under load for continuous operation
   D. Unit requires outside power source to put it in service
   E. Exciter-rheostatic regulator for main exciter is direct-acting and can be used for house generator
   F. Reactance of house generator determines ac auxiliary switchgear
   G. Motor-generator exciter can be designed for automatic transfer under load from auxiliary to house-generator bus or vice versa, provided the motor-generator has sufficient $WR^2$ built into it.

6. ***DIRECT-CONNECTED 6-PHASE GENERATOR***

   A. Not affected by system disturbances
   B. Rectifier tubes can be replaced under load
   C. Storage battery can energize unit to put it into service
   D. Uses direct-acting or electronic regulator that gives high speed of response
   E. Installed cost high because of special 6-phase generator and two ignitrons
   F. Has the added mechanical complications of a coupling and two bearings not required in No. 2

7. ***MOTOR-GENERATOR EXCITERS***

   A. Installed cost slightly higher than direct-connected exciter
   B. Excitation is affected by dips in ac voltage. Interruption in ac power supply causes rapid deceleration of motor-generator
   C. Without spare exciter, brushes must be changed under load for continuous operation
   D. Unit requires outside source of power to put it in service
   E. Uses direct-acting regulator in smaller sizes; exciter-rheostatic regulator in larger sizes
   F. Reactance of auxiliary transformer determines ac auxiliary switchgear

8. ***ELECTRONIC EXCITERS***

   A. More expensive than direct-connected exciter
   B. While output voltage of ignitron exciter is affected by system faults, designing exciter for high-ceiling voltage can compensate these effects
   C. Tubes can be replaced under load
   D. Unit can be energized by battery to put it in service
   E. Uses direct-acting or electronic regulator, which has a high speed of response

* From paper, "Excitation Systems for Turbine Generators," by M. D. Ross.

Philip Sporn, executive vice-president, American Gas & Electric Co, was awarded the AIEE 1945 Edison Medal for contributions to the art of dependable power generation and transmission. Mr. Sporn is outstanding as an engineer and executive. Under his engineering supervision a large percentage of all his company's present power generating and transmission facilities have been decided upon and installed. Since 1934 over 1,000,000 kw of generating capacity have been added. This is one of the largest continuous programs of utility power-system expansion.

should either have a high ceiling voltage or be provided with series compensators to compensate for ac-voltage drop during system disturbance. Either method is practicable.

4. An electronic exciter may be installed at any desired location in the generating station. It is easy to maintain, has an inherent high speed of response, and is easily adapted to generator-voltage regulation, but costs more than a rotating machine.

5. Modern, high-speed relaying would not be affected by using electronic exciters instead of the rotating type. Relays with settings in excess of one second might be affected if the electronic exciter operated self-excited because of faster decay of short-circuit current.

6. An ac generator, self-excited with an electronic exciter, can operate as an independent unit in an isolated station. A battery or small motor-generator can supply primer excitation for starting.

7. The long decay of short-circuit current of low-impedance faults with a self-exciting electronic exciter, prevents excessive fault damage. If desired, generator voltage can be restored by automatically applying a primer voltage to the field to start firing of the rectifier.

R B Bodine, S B Crary and A W Rankin, General Electric Co, presented a study of a motor-driven excitation set performance for large turbine alternators connected to a modern system. This set has been so designed that its performance, both steady-state and transient, is comparable with the usual direct-connected shaft-driven exciter, even when the driving motor is receiving its voltage from the alternator to which the dc generator supplies excitation.

Advantages of a motor-driven exciter for turbine-generators over the conventional high-speed exciter direct-driven from the main alternator's shaft are: (1) A motor-driven exciter is of unit construction and can be installed in less expensive locations than a direct-driven exciter. (2) It can be designed without gearing for the best dc generator speed. (3) The main alternator's design and construction are simplified.

As a result of this study the authors conclude that: (1) Motor-driven exciter of coordinated design, which meets the reliability requirements of modern power systems, is competitive and offers several advantages over the direct-connected exciter for most steam stations. (2) This greater field of application is due largely to quicker system fault clearing, high-voltage transmission-line interconnection, unit station arrangement, the development of new and improved automatic voltage regulators with variable lower limits controlled by steam flow, and ability to predict and analyze system requirements during emergency conditions. (3) Systems using modern equipment and design readily take advantage of the possibility of using motor-generator exciters. (4) Because of inherent advantages of the motor-driven exciter it is expected more and more to replace direct-connected exciters, particularly for the larger 3600-rpm units.

J E Reilly and C E Valentine, Westinghouse Electric Corp, described and gave test results for an electronic automatic voltage regulator for use with an electronic or dc rotating exciter for large machines. Tests were conducted using this regulator with an electronic exciter on a 20,000-kva, 6600-v ac 60-cycle 1800-rpm generator. Sensitivity of the regulator was well within the design goal of ± 0.5% under steady or slowly changing loads. Under sudden applications of 60% almost pure reactive load the voltage dip was about 15% of rated value. Voltage returned and stabilized at normal in about two thirds of a second but it returned to less than 4% of the rated value in less than one third of a second.

## Atomic Power

Dr John R Dunning, director, division of war research, Columbia University, pioneer in atom splitting, discussed the development of atomic energy and its possible applications. So-called "atomic energy," he emphasized, is concentrated almost entirely in the nucleus, which is made up of protons and neutrons. Twelve billion kilowatt-hours of energy would be released if a pound mass of any substance—wood, paper, uranium, gold or iron—could be completely converted into energy. The energy released by splitting the atom in a pound of Uranium-235 is 12 million kilowatt-hours because only one thousandth of the mass is converted into energy.

With a cyclotron tube, a cathode-ray oscillograph, and samples of radium and uranium, Dr Dunning demonstrated atom splitting and the use of water to slow down neutrons. This slowing down is essential to the operation of atomic piles for the production of heat and plutonium. He stressed the extreme difficulty of splitting the useful uranium isotope, U-235, from the large mass of U-238 in

natural uranium as carried out in the huge plants at Oak Ridge, Tenn. He also explained how the carbon and uranium piles at Hanford, Wash., used the energy of U-235 to convert U-238 into plutonium, a useful substitute for U-235 in bombs.

Participants in the symposium on nuclear energy were: Dr K K Darrow, Bell Laboratories, who outlined the physics of nuclear energy; Dr C G Suits, General Electric Co, who discussed the application of atomic power for peaceful purposes; and P W Swain, editor of POWER, who presented the economic angle.

Dr Darrow pointed out that the mass of the atomic nucleus is less than the sum of the mass of the protons and neutrons of which it is made. Since energy and mass are interchangeable, the loss of mass is the "binding energy" which binds the protons together in the nucleus. He explained that it is impossible to produce a chain reaction in natural uranium, because the 99.3% of U-238 present would absorb most of the neutrons produced. The natural-uranium piles used to produce plutonium must contain large masses of carbon to slow down the neutrons and thereby insure a larger percentage of hits by the U-235.

Dr Suits stated that the high cost production of atomic or nuclear energy rules out its present use for automotive and railroad power. However, large-ship propulsion seems not only possible but attractive. Large electric power plants are also in the running in areas like Australia where conventional fuel is scarce but other natural resources are abundant.

He believes development programs for the use of nuclear energy for power production should be undertaken by the power industry with governmental support, but not with the anticipation of quick application in competition with conventional fuels. Much research in nuclear and related fields will have to be done to support a long-range program. Because most of the equipment required in nuclear research is large and expensive, government support is necessary to keep this program moving, he said.

**Dr J R Dunning, director, div of war research, Columbia University. He is also technical advisor for Kellex Corp**

The war has largely used up our accumulated surplus of basic knowledge of the nucleus, and the dividend was the atomic bomb. We must, therefore, restore this surplus without delay in preparation for the peacetime job of nuclear power production. Development of economical atomic power is not a simple extrapolation of knowledge gained during the bomb work. It is a new and difficult project and great effort will be required to reach a satisfactory answer.

Dr Suits explained that a vast unknown is here to explore in an endless frontier. The goal of nuclear research is this huge storehouse of energy in the atom, 10 to 12 billion kilowatt-hours per pound. Today we obtain by fission or atom splitting of U-235 only one thousandth of this potential. Some day we might obtain more!

Mr Swain declared that the public expects too much from atomic power plants. Only one-third of the steam made by burning coal under large stationary boilers is used to generate electric power. Of the 300,000,000 tons burned annually two-thirds makes low-pressure low-temperature process and heating steam in industry. This will be a much bigger field for replacing coal if and when atomic fuels compete with coal in cost.

If atomic energy were obtainable absolutely free today, and if every pound of coal burned to make electricity were replaced by atomic fuels the resulting reduction in the cost of electricity would not exceed 15%. This total saving would be less than ½ of 1% of the national income. Since atomic energy will certainly be costly for decades, he warned against expecting it to produce any revolution in power economics.

**Dr K K Darrow, research physicist for the Bell Telephone Laboratories, Inc**

**Dr C G Suits, vice-president and director of research, General Electric Co**

**Philip W Swain, editor of Power, McGraw-Hill Publishing Company, Inc**

# THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER


# Suggested Educational Courses For Steam Power-Plant Operating Engineers

***With the increasing knowledge that modern steam plants demand, an ambitious young operator finds it harder to gather basic information on his own for advancement in his chosen field. Here are suggestions for study under experienced instructors that prepare him for later plant responsibility***


By JOHN D SWENSON

*Assistant Professor*
*The Commonwealth of Massachusetts*
*State College*

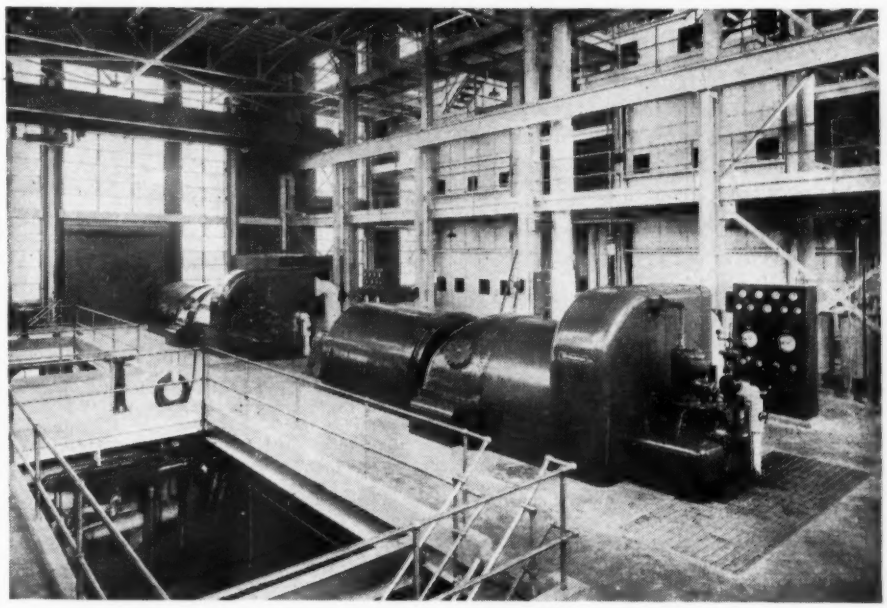

▶ AT THE PRESENT TIME it is difficult and often impossible for a young man to obtain adequate preparation for a career as a licensed operating engineer in steam power plants. Although almost no schools offer a full-time course in the stationary branch of this field, several avenues of training are open to a prospective operating engineer.

He can serve an apprenticeship by getting a job as fireman or fireman's helper and work up through the grades of fireman until he has served enough time to be eligible to take the State examination for a third-class engineer's license. To pass, he must learn a great deal during his service as fireman about the operation of boilers, reciprocating engines, turbines, pumps and other power-plant equipment.

This he does mainly by visiting power plants, consulting licensed engineers and sometimes taking correspondence courses or attending evening classes that prepare candidates for licenses. There are a number of schools that give good preparatory courses, almost entirely of a practical nature, for steam-engineering licenses. They are usually of short duration, sometimes being given in the evening.

A steam engineer who educates himself in this manner does it the hard way. This system produces many excellent operators but gives almost no background in the scientific aspects of engineering. In the day of low-capacity firetube boilers, low-speed reciprocating engines and direct machine drives this was probably no serious handicap as an operator could get along nicely on a limited technical knowledge and his own good engineering sense.

However in this day of high-capacity watertube boilers, superheated steam, air heaters, economizers, high-pressure turbines and a multitude of auxiliary equipment it becomes more and more important to have a knowledge of the principles that govern engineering. Initial



**Operators of plants like this, using higher steam pressures and temperatures, must have a knowledge of practical physics and mathematics, as well as understand equipment design and working principles to perform their responsibilities properly**

cost of modern power-plant equipment is high and it must be operated intelligently to produce at the economy for which it is designed. A knowledge of the principles in equipment design, manufacture and operation is necessary. Furthermore, the increasing demand for cheap industrial and domestic power creates a constant need for well-trained young men.

The college graduate in mechanical engineering is seldom adequately prepared to enter this field. Although his background in engineering science is generally adequate, he lacks the knowledge and experience in the practical phases of power-plant engineering to assume a responsible position in a power plant. He serves an apprenticeship, which is usually somewhat shorter than that of the man without engineering training, and during this time must study practical phases to pass an examination for a license. He encounters many of the same difficulties in obtaining information that the nonengineering apprentice does.

### *Higher License Requirements*

After obtaining his initial license an operating engineer must constantly study to advance to a higher license, in this way securing a better position. Here again he encounters some difficulty in obtaining information, especially in the more advanced work phases that he now takes up. For the nonengineering apprentice a still more serious difficulty is found in his lack of scientific background, which is more and more important as his responsibilities increase. Again this difficulty shows itself when the up-and-coming operating engineer wishes to graduate from a smaller to a larger plant where he must familiarize himself with operation, maintenance and repair of more involved equipment than he has previously encountered.

As in any other profession, he must keep up with developments in his field by reading engineering periodicals and other publications. However, there is a definite need for training courses to enable men already in the field to get better results from their plants, graduate from smaller to larger plants, and obtain better positions and assume greater responsibilities. It would be difficult to find a group of men more interested in and receptive to instruction that helps them in their chosen field. A great deal of professional benefit can be obtained from well-taught courses given to men actively engaged in the field of steam power-plant engineering.

Courses might be established for: (1) young men with no more than high-school education and little or no practical experience who wish to become licensed engineers and (2) engineers and firemen actively engaged in the field to prepare for higher licenses.

The first course above would be of two years' duration with two semesters each year, probably requiring high-school graduation as a prerequisite. An attempt should be made not to emphasize the theoretical or scientific aspects of engineering too strongly but to bear in mind that these young men are to be operators of engines.

Enough of the practical phases of steam engineering would be given to enable the student after graduation to pass the examination for a third-class engineer's license and to step into a job as an assistant engineer. On the other hand, enough of the applications of physical science and the techniques of mathematics for the solution of practical engineering problems could be given in the prescribed sequence of related courses for a fair understanding of the design, manufacture and working principles of the equipment the student will later operate.

The ultimate aim of all instruction should be to produce a young engineer who in time would be capable of making improvements in his plant and advising his employer in the purchase of new equipment. Many existing engineering colleges are well equipped to handle such a course.

A suggested curriculum for a 2-year terminal course in steam-power-plant engineering is given in the table. It would be both possible and desirable to place the student in a power plant during the vacation period between the two years. As much as five months of valuable experience might be obtained during this time. Together with a required report on the equipment and operation of the plant this experience could be made a part of the 2-year course.

### *Advanced Courses*

The second course, offered to those already in the field, could select any of the basic subjects for which a demand was found to exist. It would perhaps be advisable to give some of the classes in the 2-year curriculum in the late afternoon or evening so that they might be attended by men who work. More advanced engineering courses might also be offered if enough men were interested.

More and more those associated with technical education realize that industry has a much greater need for those prepared for specific technical lines of activity rather than for broad sectors of engineering practice. In recognition of this there is a trend to broaden the scope of engineering education by offering 2-year technical courses in a large variety of specialized fields. In these courses the curricula are briefer, more intensive and more specific in purpose than collegiate engineering curricula, although they lie in the same general field of industry and engineering.

The Committee on Engineering Schools, of the Engineers' Council for Professional Development, which is the joint agency of the principal national engineering societies of the U. S. and Canada, has set up a list of standards to be met by various schools giving these courses to have their technical courses accredited. This is to be done in much the same way as the accrediting of colleges by the engineering societies and has practically the same significance. A 2-year course in steam engineering as outlined, if properly set up, could obtain a good rating. This would increase the opportunities of the graduate of such a course to obtain a good position.

Graduates of a course of this type would also be qualified for a number of jobs in the design, manufacture and erection of steam power-plant equipment.

## Two-Year Study Course to Train Steam Power-Plant Operating Engineers

**FIRST YEAR**

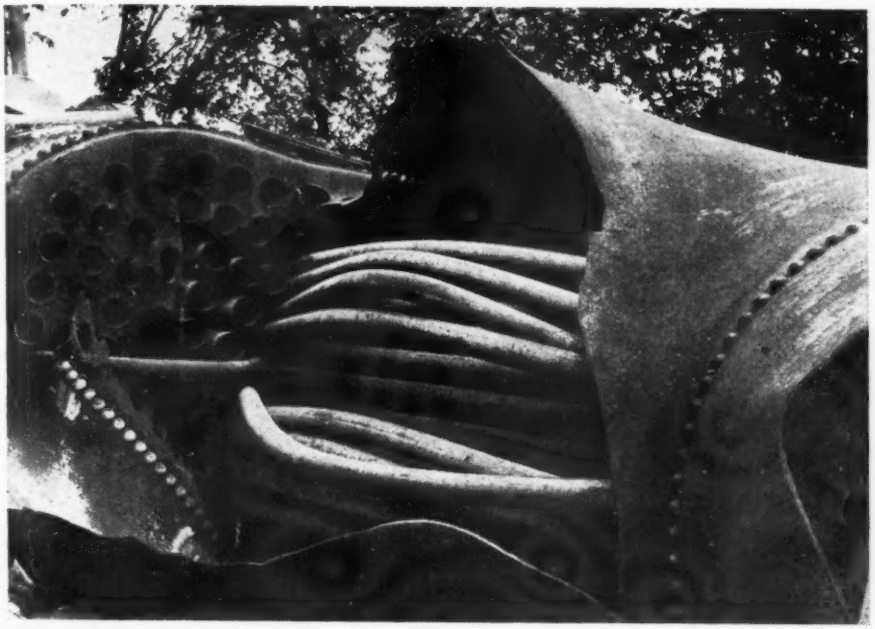
| *First semester* | *Second semester* |
|---|---|
| Mathematics: algebra and geometry | Mathematics: slide rule, shop mathematics and engineering problems |
| Physics | Physics |
| General chemistry | Applied chemistry: feedwater treatment, fuel analysis, combustion |
| Engineering drawing | Shop work: machine shop, pipe fitting, welding |
| Steam power plants: introductory | Technical English |
| English composition | |

**SECOND YEAR**

| *First semester* | *Second semester* |
|---|---|
| Applied mechanics: statistics and dynamics | Metallurgy and strength of materials: applications to ASME Boiler Code |
| Steam power-plant operation and maintenance | Steam-power-plant operation and maintenance |
| Principles of steam engineering | Principles of steam engineering |
| Electricity: dc machinery | Electricity: ac machinery |
| Materials-testing laboratory | Elements of machine design |
| Economics | Industrial organization |

# How a ¼-Inch Pipe Can Explode a Boiler

***Because modern boiler rooms create an impression that explosions just "can't happen here," Harry M Spring recalls a disaster resulting from a small, plugged pipeline. He suggests sound preventive measures for use in any size boiler plant***



An idea of the tremendous force controlled within boilers can be drawn from this photograph of twisted tubes and torn shell that resulted from a boiler explosion

▶ RECOUNTING A DISASTROUS EXPLOSION that occurred some years ago may serve to stress the seriousness of such an event. Its comparatively trivial cause, the plugging of a ¼-inch line that connected a steam-pressure gage to the boiler drum, could develop anywhere so its aftermath holds universal interest.

Back in 1910 a locomotive boiler in Massachusetts served an icehouse with steam for an engine-operated conveyor. A spring pop safety valve had just replaced a ball and lever one.

On a Monday morning a fireman began building up the fires at about 7:00 am for an expected 9:00-am engine load. At the latter time with a pressure gage reading of only 38 psi, the safety valve popped. Since 70-psi pressure operated the steam engine, this fireman thought the safety valve was out of adjustment. To correct the fancied error he screwed down on the compression spring.

After the boiler was fired still further, an engineer came to the boilerhouse to determine why the steam line to the engine had not been opened. Once again the boiler under question relieved itself through its safety valve at scale reading, this time, of 40 psig. Immediately the gage underwent testing and the plant shut down for the day.

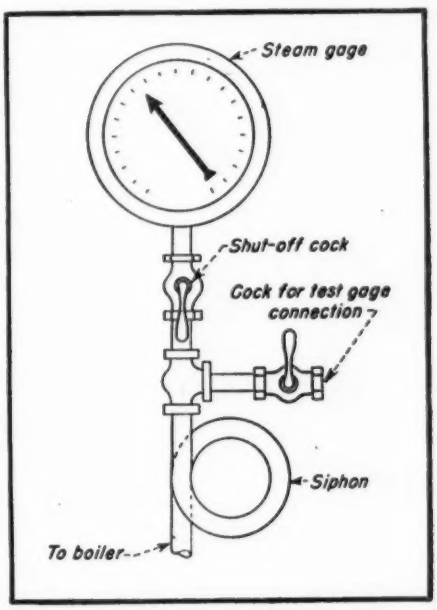
The next day, within an hour of firing a pressure reading of 40 psi brought about a popping of the safety valve. The fireman resorted to tightening down the compression spring of the safety valve. With still harder firing, the safety valve popped every time at 40 to 50 psi. In each instance one more turn was taken on the compression spring nut.

For 3½ hours this alternate firing and screwing down continued until the blower at full blast, according to eye witnesses, poured cinders and fire clear through the top of the stack. Finally, when pressure reached ultimate boiler strength, pieces of boiler and boilerhouse scattered over a wide area. As a result, 17 persons died, one being blown to pieces.

An excerpt from findings at the formal inquest states: "that the abovementioned deceased persons came to their deaths by reason of the explosion of said boiler. That the explosion of the boiler was due to a pressure of steam greatly in excess of the pressure allowed by the Inspection Department, and caused by the screwing down of the compression screw on the safety valve. I find that the reason the steam gage failed to register correctly the pressure of steam was probably due to rust from the pipe underneath it clogging the stopcock of the steam gage."

An operating check to prevent such a calamity seems easy. When firing up a boiler, keep a vent open until steam shows. After steam blows freely from this vent, open a test connection on the pressure-gage line. A free flow of steam indicates a clear line.

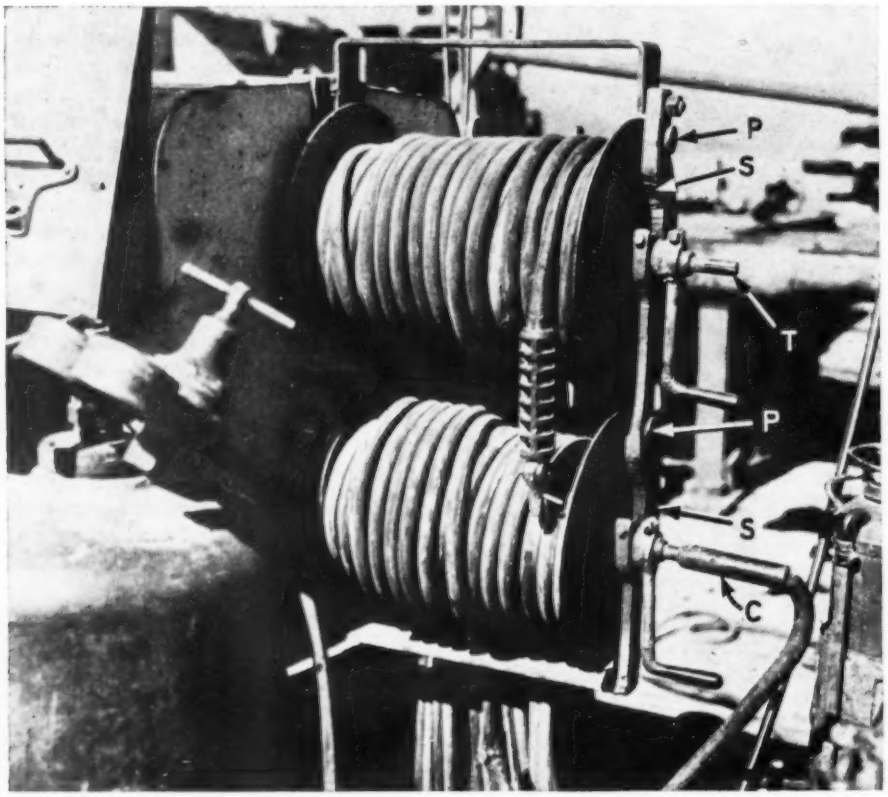
If a safety valve blows at a pressure that on the gage seems below normal, the last thing to do is to adjust the compression spring. Test the pressure gage and see that piping from boiler to gage gives indications of no blocking. Use of the test connection serves this purpose. But it is best to shut off the petcock to the pressure gage during and just after blowing through the line. This insures a water seal in the siphon as a safeguard against overheating the gage. For best practice, however, remove the pressure gage entirely and blow out all piping clear to the end, thereby assuring a clean line.




Various points of simple pressure gage allow tests to determine clogged piping

# PRACTICAL AIDS TO OPERATION

*Plant-Tested Methods and Ideas for Power Men*




## PREVENT DETERIORATION OF WELDING CABLE

FREQUENT REPLACEMENT of costly and difficult-to-obtain electrode cables may be a major upkeep item on portable electric-welding units. Cables may deteriorate seriously from causes other than weather and scuffing of the rubber insulation. A welder in one large plant, when attempting to determine why his cables became hard and brittle prematurely even though they were carefully handled and kept wound on spools, discovered the cause in the steel cores of the spools.

He found that the cable's inner layers on the spools, even though much less used and seldom exposed to weather, were the first to show evidence of stiffening and embrittlement. Not only did the heavy rubber insulation crack, but the copper wire itself ultimately became brittle and eventually broke inside the insulation when flexed during removal from the reel. Believing that eddy currents were being generated in the spool's steel core, which produced heat detrimental to the cable, he substituted a wooden core for the steel one. Since making this change the cables have remained pliable down to the last turn on the reel.

The spools are arranged on a rack so that the cables can be crank-wound on them, as in the photo. This rack is made of two pieces of ¾-in. steel plate bolted at their two ends to steel brackets that support them a spool's length apart. J-slots *S* cut in the plates' edge support the spools' axles.

One end of the cable on each reel connects to a terminal *T* that comes out the axle's end. Connection is made to these terminals with slip-on connectors as at *C*. Before making these connections the necessary length of cable to reach the job is unreeled and the reel locked in place by a steel pin *P* through a hole in the frame and any one of four holes in the spool's outer edge. When the job is done the connections *C* are pulled free of the reel terminals and the cables wound on the spools with the cranks.

*Pomona, Calif.* G M WILSON

## Why Are These Unsafe Conditions Permitted?

CENTRAL-STATION POWER SERVICE was flooded in a town on the Ohio River. One manufacturing plant had been buying power but had a reserve steam plant that had been shut down. It consisted of two boilers designed to operate at 200 psi and a 600-hp and a 200-hp engine directly connected to alternators. One engine was designed to operate on 135-psi steam and the other on 100. This unhealthy combination was installed shortly after World War I, with no attempt to make the plant successful.

Preliminary studies showed the equipment to be in fairly good condition but developed stories of slugs of water from the boilers coming over into the engine cylinders, broken cylinder head bolts, crankpin and connecting-rod troubles, and the like. While the plant was being put in condition the large engine's piston was removed and engine alignment checked before replacing a cracked front cylinder head.

This check revealed that the outboard bearing was nearly ½ in. too close to the cylinder, an unbelievable condition. No wonder the crankpin and connecting-rod bolts caused trouble. Misalignment was so great that the generator's stator had to be moved to match the crankshaft's new position, the old holes plugged and new ones drilled and tapped for the holding-down bolts.

The crankpin appeared to be in good condition but when the engine was put in service the pin ran hot. This condition was corrected by truing the pin in position. After this was done the engine operated satisfactorily during several years of overloaded service.

Nothing was done to the main bearings to refinish them to the new position after engine alignment. They were given care-

ful attention, plenty of good lubricant, and properly taken up at intervals. During this running-in period they gave no trouble, but caused us some anxiety.

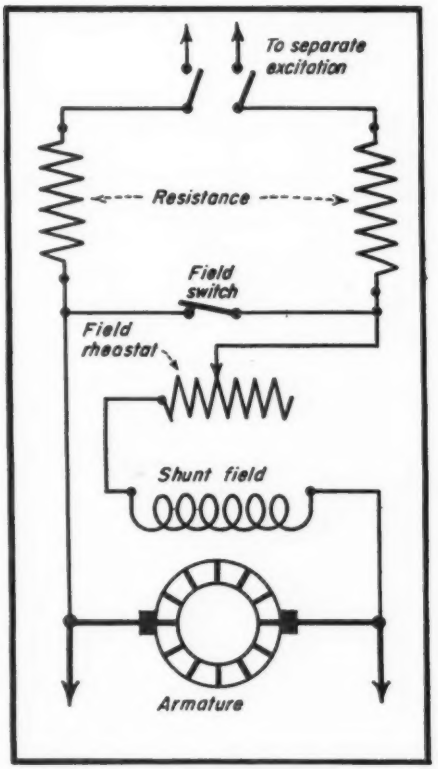
None of the conditions mentioned should be permitted, but they do exist as this plant showed.

*Cincinnati, O.* H B McDermid

## Separate Excitation For Rotary Converters

Rotary converters can build up their voltage in either polarity but generally have a bias toward the correct one because of the residual magnetism in their polepieces. Separate excitation is sometimes installed to insure correct polarity when starting the machines. This frequently is a double-throw switch connected to the field coils for self-excitation and for separate excitation. Normally this switch remains in the self-excitation position until the converter approaches full speed.

If the voltage builds up the wrong polarity or hunts around zero, the field switch is closed to separate excitation until machine's polarity comes correct. Field-discharge contacts, and resistance limits arcing at the switches and the induced voltage in the field coils when the switch is opened. Do not start the converter with separate excitation in the field coils, or apply it until the machine approaches normal speed because accelerating time may increase to where the starting motor may overheat.




Separate excitation voltage can be as low as 20% of machine-rated volts. The diagram shows the connections for separate excitation in our plant. With this arrangement the single-pole field switch normally remains closed until the separate excitation switch is closed through the limiting resistance. Then the field switch is opened to apply excitation to the field coils and establish correct polarity. After synchronizing, the single-pole field switch is closed and the double-pole opened. This method of separate excitation has been satisfactory using 100-v separate excitation on a 550-v converter.

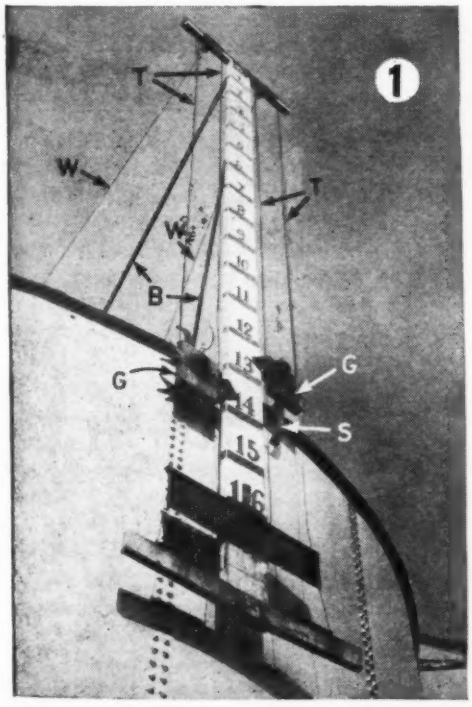
*Bolton, England* W M Gore

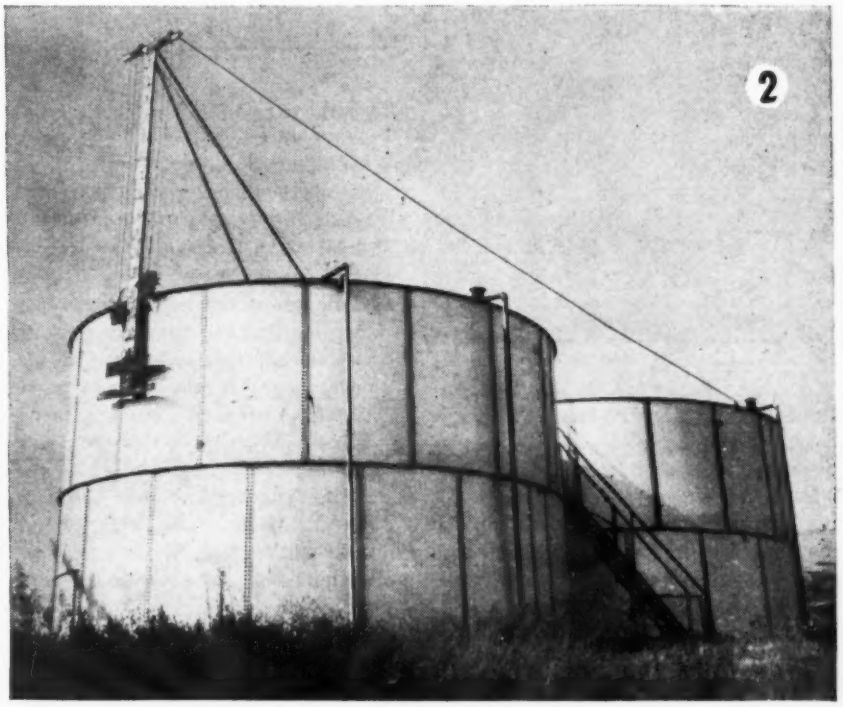
## EASILY READ DUAL-TANK DISTANT WATER-LEVEL INDICATOR

To eliminate going to the top of a nearby hill to check water level in two storage tanks the superintendent of a large processing plant installed on the tanks large level indicators that can be seen more than 1000 ft away. As the photos show, the gage board consists of a heavy plank painted white, marked off in feet, and erected atop the nearest tank.

Bolted to the tank near its eaves, the gage board is also braced to the tank's top by two 2-in. pipes, *B*. A short crossarm on the gage board's top supports two pulleys over which the gage-float wires pass. From each end of the top crossarm a steel wire *W* ties the gage board back onto the pipe braces *B*.

Indicators are made of 1-ft-square wood blocks *G* with metal pointers on their fronts that are painted black. Two pairs of tightly stretched wires *T* between

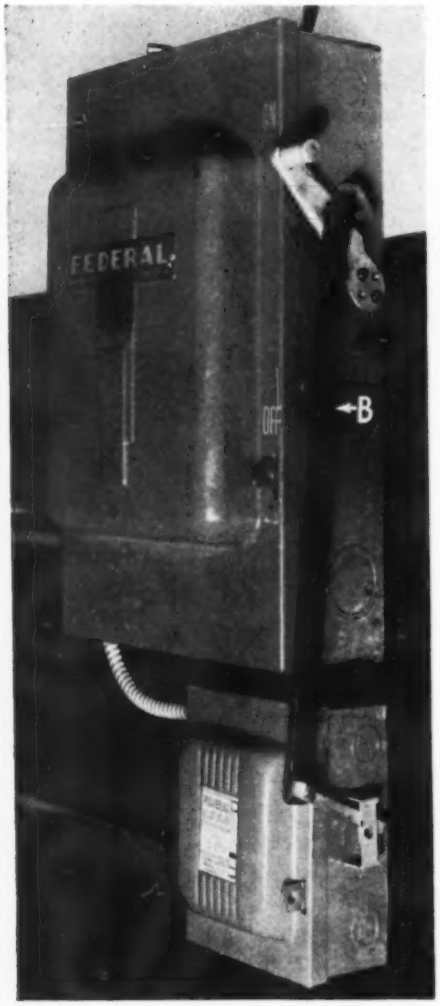


the top and bottom crossarms, pass through screweyes in the vertical edges of the wood blocks, and guide the indicators parallel to the gageboard. Semicircular steel guides *S* on the tank's top permit the indicators to pass the eaves without snagging.

Unlike gages on many tanks this one eliminates having to go close to it to check the water level. Also setting its top end 13 ft above the tank's top permitted the gage to be read above the tops of buildings that would otherwise interfere with seeing the gage.

*Pomona, Calif.* G M WILSON

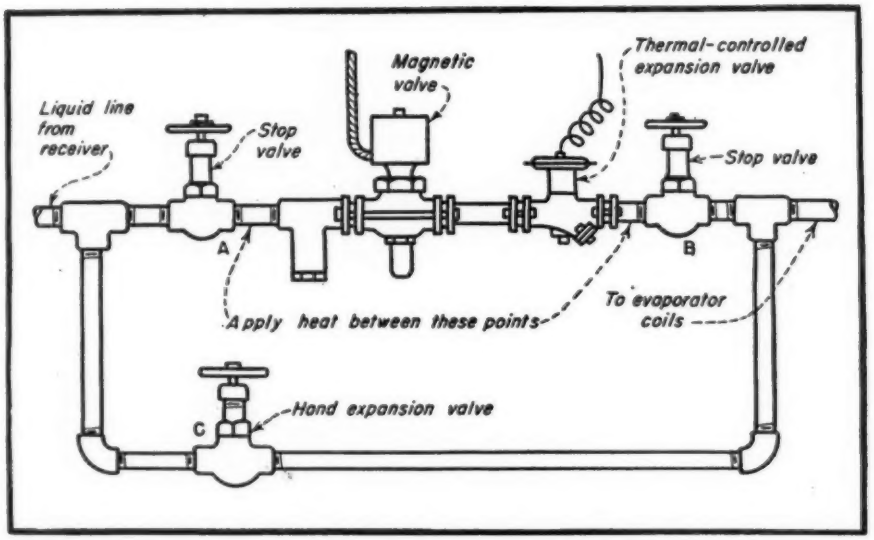



## Puts Safe Operation in Safety Switches

ON A RECENTLY MODERNIZED ELEVATOR, the motor and its controller are supplied from a dc power system while the signal system and car-door timing relay operate from ac. Each power source required a fused safety switch. For correct and safe operation of the equipment it is desirable that both switches operate together. That is, if the car is in operation both switches must be closed, and if the equipment becomes dead while being worked on, both switches should be open.

To insure these switches always operating correctly, the smaller switch was installed below the larger, as in the photo, and their operating levers connected by a bar *B*. Because the larger switch has a longer operating lever than the smaller one, the bar's lower end was pinned to the outer end of the latter's lever. The bar's upper end was then connected at a point on the larger-switch lever that permits correct operation of both switches from this lever. This arrangement insures opening and closing both switches simultaneously and eliminates the human element.

*New York, N. Y.* M A MYERS
*Electrical Engineer*
*The Maintenance Co*




## REMOVES AMMONIA FROM EXPANSION VALVE

TO REMOVE AN EXPANSION VALVE for repairs from an ammonia-refrigeration system is often a disagreeable job. This is true no matter whether the system is thermal or pressure controlled. Our method, which eliminates most of the annoying fumes usually escaping when we remove the expansion valve, is as follows:

(1) Have ammonia compressor in normal operation. (2) Close liquid stop valve *A*, in diagram. (3) Open magnetic valve by setting thermostat at low pressure, or using hand jack. (4) Remove usual accumulation of ice from expansion valve and piping. (5) Apply rags soaked in hot water to the pipe and fittings between stop valves *A* and *B* until pipe and valves are warm. This causes rapid evaporation of the liquid refrigerant and superheats the vapor produced, which is forced out into the evaporator coils. (6) Close valve *B* at expansion-valve outlet.

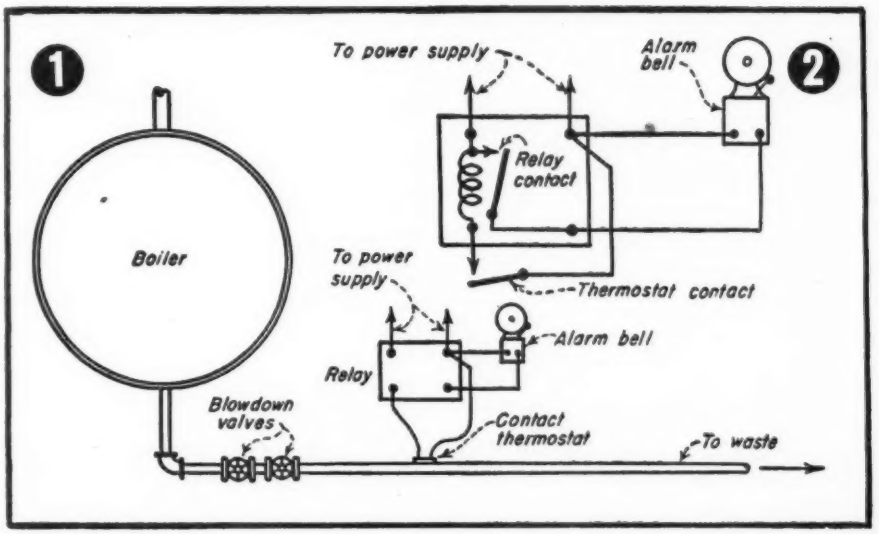
Expansion valve is now ready for removal. If needed, use hand expansion valve to supply refrigeration. When automatic expansion valve has been repaired or replaced, open stop valve *B* to obtain a low-pressure tests for leaks. If they do not develop open valve *A*, and if the system is still tight close hand expansion valve *C*. Reset thermostat to normal, or release hand jack on the magnetic valve. Expansion valve can now be adjusted as required.

*Bellingham, Wash.* DEAN H BERGMAN

## Filters Solve Gear Lubricant Problem

OPERATING ON THE PREMISE that there is a cause for every malady, Westinghouse engineers found the reason for an annoying epidemic of excessive gear wear. As is so often true, the cause was simple. Flyash or other abrasive dust was getting into the lubricating oil. It's no new idea that hard dirt particles in gear lubricants are not good, but it was not appreciated how small an amount of flyash, ore dust, or even log-bark dust, can cause serious consequences.

In one case, gears of a turbine-driven induced-draft fan were wearing and becoming noisy in a few days. Analysis of the lubricating oil indicated the presence of a small amount of flyash. Applying adequate oil filters completely solved the problem.




## DON'T FORGET THE BLOWDOWN VALVES

PROBABLY MORE BOILERS have been overheated to destruction by forgotten blowdown valves than by any other cause. Records show that almost every week a boiler is damaged beyond repair because an operator when blowing down a boiler had his attention distracted, walking away and leaving the blowdown valve open. The diagrams show an easily constructed signal to prevent forgetting an open blowdown valve.

A contact thermostat is clamped to the blowdown pipe on the valve's discharge side and wired through a relay to a dependable source of power and an alarm bell or horn. When the valves are opened to blowdown the boiler, heat in the discharge piping actuates the thermostat to sound the alarm. Accordingly, place it where it is easily heard and cannot be disregarded. This system not only reduces the possibility of forgetting a blowdown valve but also serves to call attention to failure or severe leaks in these valves. Fig. 2 shows the circuits for the alarm system. A similar warning might be actuated by a pressure contact but the severe service might render such a system inoperative.

*Canton, Mass.* HARRY M SPRING

## Motor Operates at A Critical Load

INCLUDED IN THE MOTOR EQUIPMENT of a wood-working factory were three Fynn Weischel motors rated 40, 50 and 60 hp that powered exhaust fans and corrected power factor. During depression years many machines were idle and to reduce power load of the fans their speed was reduced by changing the pulley ratios of their flat-belt drives. Later when business picked up and more machines went into service it was necessary to bring the fans back to their former speed.

On the 50-hp fan, the original pulleys had been used for another purpose. The new ones that replaced them increased fan speed enough to put a small overload on the motor. All went well for some time until one day the indicating wattmeter started to swing violently across the scale; then for no apparent reason it settled down to normal. This performance was repeated at irregular intervals.

The overloaded fan motor was suspected of causing the power pulsations, but from outside appearances its operation was normal. One day an electrical engineer of the motor company was in the plant when the wattmeter was having a bad spell. When looking for the cause of the trouble he discovered the exhaust gates open on some idle machine. Closing these stopped the power pulsations. Later experience proved that closing a few exhaust gates always stopped these pulsations.

It happened that the motor had a critical point slightly above its normal full load where it was unstable. Opening a few exhaust gates increased load on the motor sufficiently to bring its load in the unstable range, and closing these gates brought the load back to stable operation. When the cause of the trouble was known it was easy to adjust the load to a stable value.

*Cincinnati, O.* H B MCDERMID

## Portable Lamp Is Made Self-Supporting

PORTABLE LAMPS have been built in many forms but we have made one that is not only portable but is self-supporting in any position. The lamp stand's base is made of ½-in. pipe with fittings, as in the photograph below. Halfway up the pipe column we installed a fitting with two plug-in connections at *A*, that provide convenient outlet for portable tools.

The lamp holder-and-shade is from an old, flexibly supported desk lamp. From this we removed the base and threaded the free end of flexible extension into the top of a ½-in. pipe column. The flexible support can be easily adjusted to hold the lamp in any position to bring the light directly on the work.

With an ordinary portable lamp on an extension cord it frequently is quite a problem to find a place to hang the lamp and have it in the best position to light the work, particularly around motor controllers. With the light supported as in the photo it can be placed in any position desired, leaving the workman free to make inspection and repairs. To permit the lamp being placed near uninsulated circuits without danger of causing short circuits we thoroughly insulated its shade and flexible support with friction tape.

*New York, N. Y.* FRANK SCHLIEFF

# READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

## 1—What Refrigeration Controls Are the Best?

I WOULD LIKE TO KNOW how many different arrangements of temperature, pressure and level control can be used on the following general refrigeration systems: (1) single installation of a flooded or dry evaporator and one condensing unit. (2) multiple installation of two or more evaporators, operating either dry or flooded, and connected to one condensing unit. (3) multi-temperature system consisting of two or more evaporators each operating at a different temperature, either flooded or dry, and all connected to a single condensing unit in the system.

I realize this involves many varieties of control systems, but I would like to know what the best type is for each system. Will POWER readers describe control systems they have used and show how they were connected?—*LRT*

## 2—How Can I Correct This Engine Governor?

A SECONDHAND 2-CYLINDER uniflow steam engine, direct-connected to a 300-kw ac generator, supplies some of the power in our building. The generator is synchronized with the local power system because average load consists of 465 kw of which 300 kw is supplied by the engine and the remainder by the power company. For normal operation we adjust the load on the engine by compressing a spring with the synchronizing motor on the engine governor. The engine load has always been selected and adjusted manually. On a few occasions recently our load has dropped off. Every time it goes below 300 kw reverse power relays open the circuit to the utility system and our engine overspeeds and trips off.

I have never heard of this happening on other engines operating like ours. I believe there is some defect in the governor that keeps it from regulating the speed on loads below selected values. The governor is a simple flyball type mechanically connected to the engine valve-mechanism. The only adjustment I can find is the motor-operated spring for synchronizing and adjusting the load.

I would like to know whether POWER readers have experienced similar conditions and how to correct the trouble without buying a new governor?—*JAE*

---

# Answers to January Questions

## What Is Wrong With This Engine

*(This is Question 1 from the January issue, with best answers from readers.)*

THE DIAGRAMS *in Q-1 were obtained from a tandem-compound steam engine running condensing and driving a rotary blower that compresses air from 15-in. water-column pressure to 5 psi.*

*Engine has poppet valves and adjustable cutoff. Here are other data: cylinders 15½ and 26x27 in.; 150 rpm; horsepower, normal 400, maximum 525; 6-in. steam line; 7-in. pipe serves as receiver between cylinders; 9-in. exhaust to condenser. Receiver is fitted with a trap and pressure relief valve set for 60 psi. Throttle pressure is 160 psi, 120-F superheat, and the exhaust vacuum is 25 in. Hg.*

*When operating at 120 rpm steam exhaust from h-p cylinder at 40 psi yet it enters the l-p cylinder at 5 psi. If engine speed is reduced to 100-80 rpm, exhaust pressure falls almost to atmospheric (see sketch) although it is released at about 40 psi. Two different indicators have been used and both checked for trouble such as loose springs. Instrument piping and receiver were checked for leaks. Can* POWER *readers explain this loss of pressure in the receiver between the cylinders?—FKG*

### Adjust Cutoff and Exhaust of L-P Cylinder

FOR BEST EFFICIENCY and performance *FKG* should install a receiver of about eight to ten times the volume of the h-p cylinder.

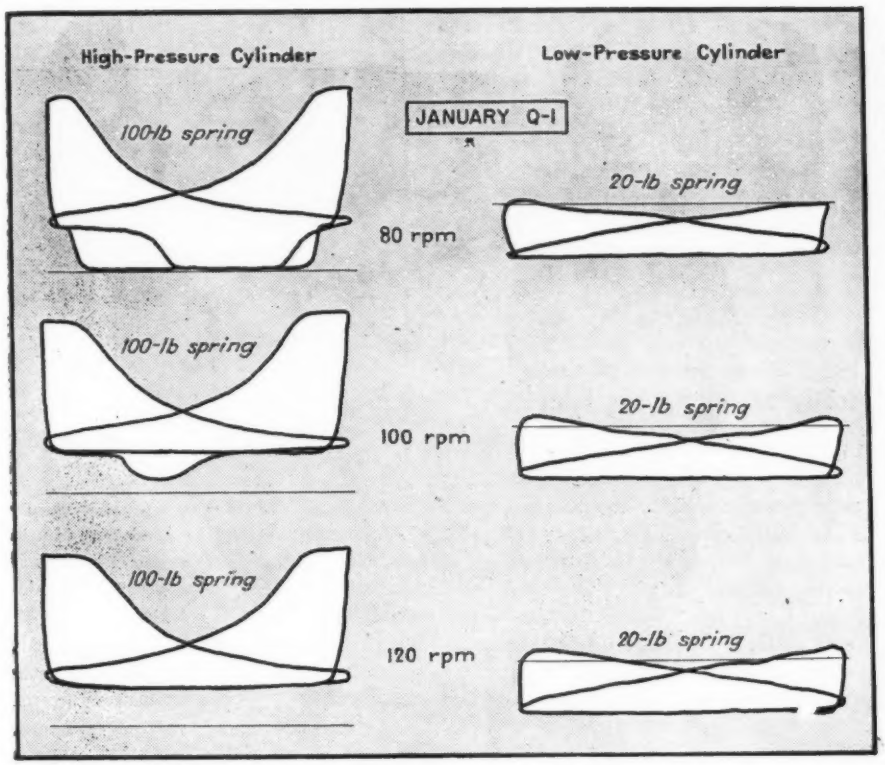
A study of the indicator cards does not show anything wrong with the valve setting of the h-p cylinder. However the cutoff stroke of the l-p cylinder is entirely too long. It appears to be about a ¾ or ⅞ stroke. This is the cause of the low receiver pressure and the drop in the exhaust line on the h-p diagram. This drop takes place as the l-p piston approaches maximum velocity and is a little earlier on the overstroke than on the understroke because of the angularity of the connecting rod.

The indicator cards, January Q-1 sketch, show that the engine is governed by the cutoff stroke of the h-p cylinder. Therefore, with this cylinder-volume ratio and with a receiver of proper size *FKG's* engine would probably operate most efficiently with a l-p cutoff of about ⅓ stroke. However, with the present receiver he should try moving the l-p cutoff up to about ⅜ stroke. Since we do not know the volume of the receiver, it is impossible to calculate the pressure at the end of the l-p cut-off stroke or at the end of the h-p exhaust stroke.

*South Amboy, N. J.* RAY SEPTOR

### Change L-P Cutoff To Divide the Load

BETWEEN 80 AND 100 RPM on *FKG's* engine pressures approach atmospheric line; therefore l-p cutoff may be too late. Volume of steam taken from receiver by l-p cylinder is greater than released from h-p cylinder. When steam is released from the latter it expands to receiver




volume and therefore produces lower pressure.

Receiver pressure can be increased by lengthening cutoff in h-p cylinder but this will cause engine to develop more power. To develop same power and raise the receiver pressure, l-p cutoff should be made earlier. This helps divide the load between the two cylinders. If the l-p cylinder volume is equal to that of the receiver, pressure should not vary because volume released from h-p cylinder will be nearly equal to that taken by l-p cylinder.

*Port Dalhousie, Ont.* C R CREIGHTON

## Steam Receiver Is Too Small

A STUDY OF SKETCH showing indicator diagrams, January Q-1, reveals that cutoff in l-p cylinder cannot be readily determined. Falling and rising of pressure in exhaust lines of h-p cards taken at 80 rpm is probably due to opening and closing of l-p valves. This shows that h-p cutoff is not equal to l-p.

Because terminal pressure on h-p cylinder, operating at 120 rpm, is 40 psi and initial pressure on l-p cylinder is only 5 psi I suggest taking indicator cards from receiver. Indicator should be attached to reducing motion exactly the same as when taking cards from cylinders. Pressure changes should be noted through both strokes on both cylinders. Cutoff on l-p cylinder should be equalized and shortened and effect observed on receiver pressure.

A careful check of valves and piston on l-p cylinder should be made, because it looks as though large quantities of steam are passing through this cylinder as the result of long cutoff or blowby. A record of temperature changes in receiver may also be of value.

Rapid pressure variations in exhaust line of h-p cards at 80 rpm makes me believe that there are no obstructions in exhaust ports of h-p cylinder, receiver or steam ports of l-p cylinder. However, if receiver is arranged as shown in sketch 1-C, it is too small and is responsible for some of the trouble.

*Kenmore, N. Y.* R E FONTAIN

## Indicator at Fault

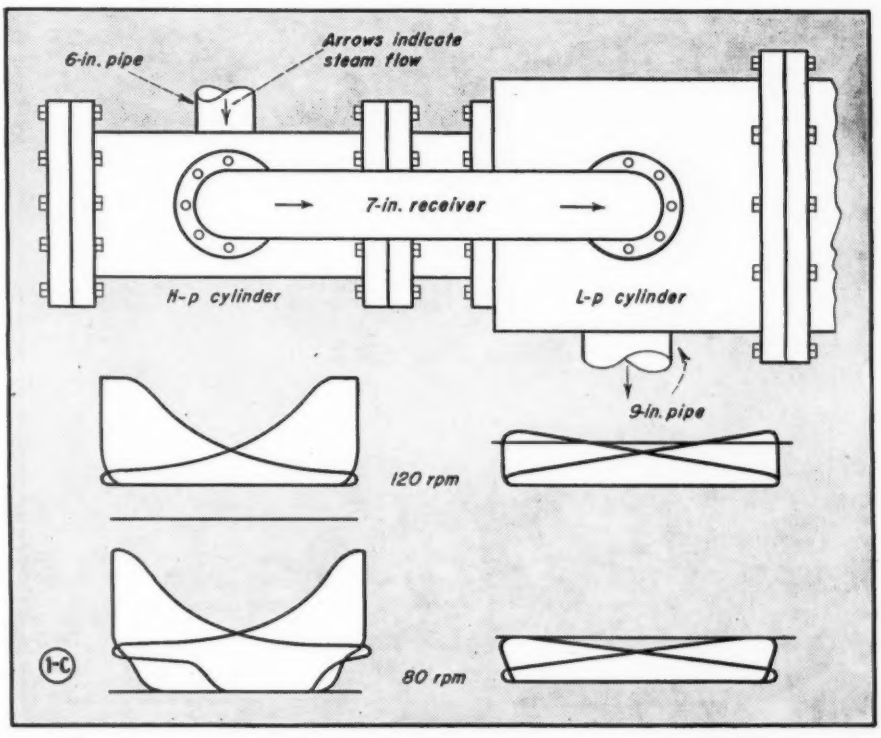
IT APPEARS that *FKG's* indicator readings are at fault. Trouble is caused by short cord, drum bumping, or improper setup and adjustments of indicator.

*Oaklyn, N. J.* C A WILKES

## Enlarge Header And Adjust Valves

FKG DOES NOT STATE whether his engine trouble has just started or has been going on some time. Neither does he say whether any adjustments or repairs have been made to the valve gear or governor. Assuming that the trouble has just started, the valve gear and governor should be properly adjusted.

If the cutoff is fixed on the l-p cylinder, the receiver pressure will be fixed and will vary with the load. If the l-p cutoff is adjustable, the receiver pressure should be more stable. If the l-p cylinder cutoff is made after the h-p cylinder cuts off, receiver pressure will be lowered and the h-p cylinder will do more work. Sketch January Q-1 indicates that



the h-p cylinder exhausts at 40 psi and steam enters the l-p cylinder at 5 psi. Indicator cards show that the l-p cutoff is too late, thereby making the h-p cylinder do most of the work.

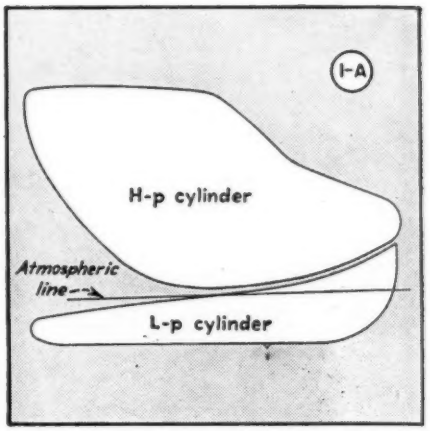
Another cause of trouble is in the receiver, which is too small. Tandem compound engines should have a receiver volume at least one half that of the h-p cylinder. In this case the receiver would have to be 5½ or 6 ft long using 7-in. standard pipe. The receiver should be well insulated if subjected to cold currents of air or moisture to prevent condensation. Valve gear and governor should be adjusted, after the correct receiver volume is installed, until the proper receiver pressure is maintained. Best receiver pressure, of course, is that which equalizes the work between the two cylinders. This result can be had by making adjustments to the valve gear and taking successive cards on both cylinders at the same load and varying the receiver pressure.

If the receiver pressure cannot be properly maintained or the work cannot be equalized between the two cylinders, the receiver is too small, thereby allowing all the steam to exhaust from the receiver before the l-p steam valve closes; thus low receiver pressures result. In reference to resetting the valves, remember that the lead of the l-p steam valves should not exceed more than ⅛ to ¼ in. per foot of stroke more than the h-p valves.

*Baltimore, Md.* C W PARKS

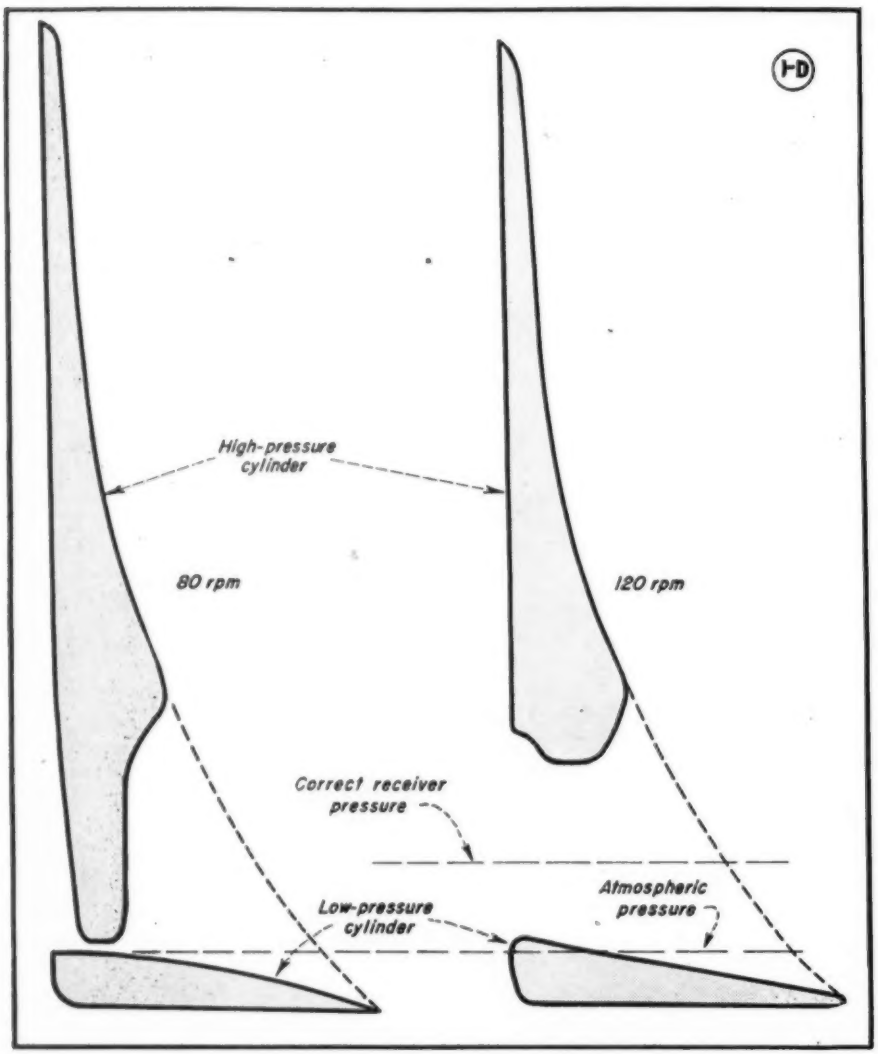
## High-Pressure Cylinder Does Most of the Work

IN FKG'S PROBLEM, h-p and l-p cylinder cards have been replotted in sketch 1-D to show a combined diagram for the 80- and 120-rpm operation. The l-p card is to the same scale as the original sketch, January Q-1. The h-p diagram has been plotted to the same scale as the l-p by multiplying the pressures by the ratio of the indicator springs and the volumes by the ratio of the two cylinder volumes. This gives a combined card showing the relation between the two cylinders more clearly. About 70% of the work is done in the h-p cylinder. At 120 rpm the h-p cylinder exhaust is about 15 psi higher than normal.




To correct the trouble all engine valves should be carefully checked for mechanical defects. After necessary repairs have been made, valve adjustments should be carefully set to equalize the work between the cylinders at normal full load. In making this adjustment the indicator should be connected to the receiver to show variations in receiver pressure for several load cycles, in addition to taking cards from each cylinder.

*Saint John, N. B.* C G CLARK



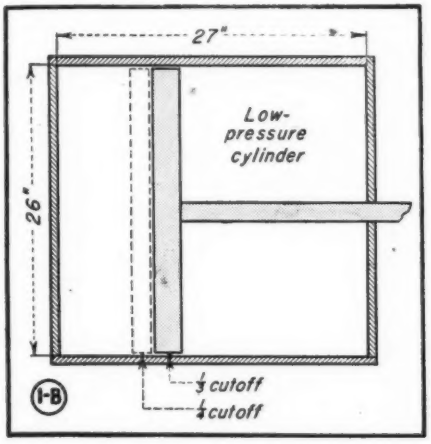

## The High-Pressure Cutoff Is Too Short

IN FKG'S PROBLEM, I think the trouble is due to having too short a cutoff on the h-p cylinder. The steam line on the h-p indicator card shows this. Even though the h-p cylinder exhausts at 40 psi the quantity of steam is not enough to supply the l-p cylinder; therefore, the pressure drops. This condition becomes worse as engine speed decreases because l-p steam supply depends on the amount supplied to the h-p cylinder. This decreases as the speed of the engine drops thus starving the l-p cylinder. Indicator cards for *FKG's* engine should look something like the sample shown in sketch 1-A.

*S. Vineland, N. J.* T DEROSA

## Cutoff Too Early On L-P Cylinder

FKG'S PROBLEM is quite simple because the cutoff is too early on the l-p cylinder. Sketch 1-B shows that with a 26x27-in. cylinder and cut-off at one third of the stroke, volume of steam taken from the 7-inch receiver would be: 26x26x0.785x




9 = 4778 cu in. If the steam valves were adjusted to cutoff at one quarter stroke, 26x26x0.785x6.75 = 3683 cu in. of steam would be removed from the receiver. The difference equals 1195 cu in., which remains in the receiver at the end of each stroke and which naturally raises the pressure considerably.

In the operation of a compound engine a curve should be plotted for load conditions versus speed so that the receiver pressure can be varied to divide the load evenly between the two cylinders.

*Duluth, Minn.* E R WEBBER

## Receiver Obstruction Restricts the Flow

THERE IS UNDOUBTEDLY an obstruction in the receiver from the h-p to the l-p cylinder. This could be an orifice plate inserted between flanges, or some other object that obstructs the free flow of steam to the l-p cylinder.

When the engine is running at 80 rpm the opening has the capacity to let the pressure fall gradually to l-p admission pressure. When the l-p admission valves close late in the stroke the pressure again rises, as in sketch January Q-1.

At 100 rpm a greater volume of steam is handled and the opening through the obstruction is not large enough to allow the pressure to drop except during the exhaust from one cylinder. The 120-rpm volume of steam is large enough so that only a slight drop is noticeable in exhaust lines near the middle of each stroke.

I advise *FKG* to take down and examine the receiver pipe. I have a tandem engine with a 16x36 in. h-p cylinder that runs 120 rpm. It has a 6-in. pipe for a receiver but no such condition similar to *FKG's* ever showed up on the indicator cards. This proves to me that the receiver pipe is large enough.

*Clarkdale, Ariz.* FRANK AVIS

## Which Conveyor Is Best for Coal?

*(This is Question 2 from the January issue, with best answers from readers.)*

WE ARE INSTALLING *a bin-feed stoker that will take coal from a storage bin adjacent to the boiler room. Coal will be trucked and dumped into a pit hopper at the base of the storage bin. Coal is 2 in. in size.*

*I expect to install a conveyor to lift the coal into the storage bin, a distance of 22 ft. How does a jet unit compare to a bucket conveyor in regard to initial and operating costs? Also what size tube (jet conveyor) and steam-supply pipe would be most satisfactory? Would it be best to insert the nozzle at the bottom and blow the coal up, or put the nozzle at the top and pull a vacuum on the line?—JHL*

## Steam Jet Conveyor Is the Best Type

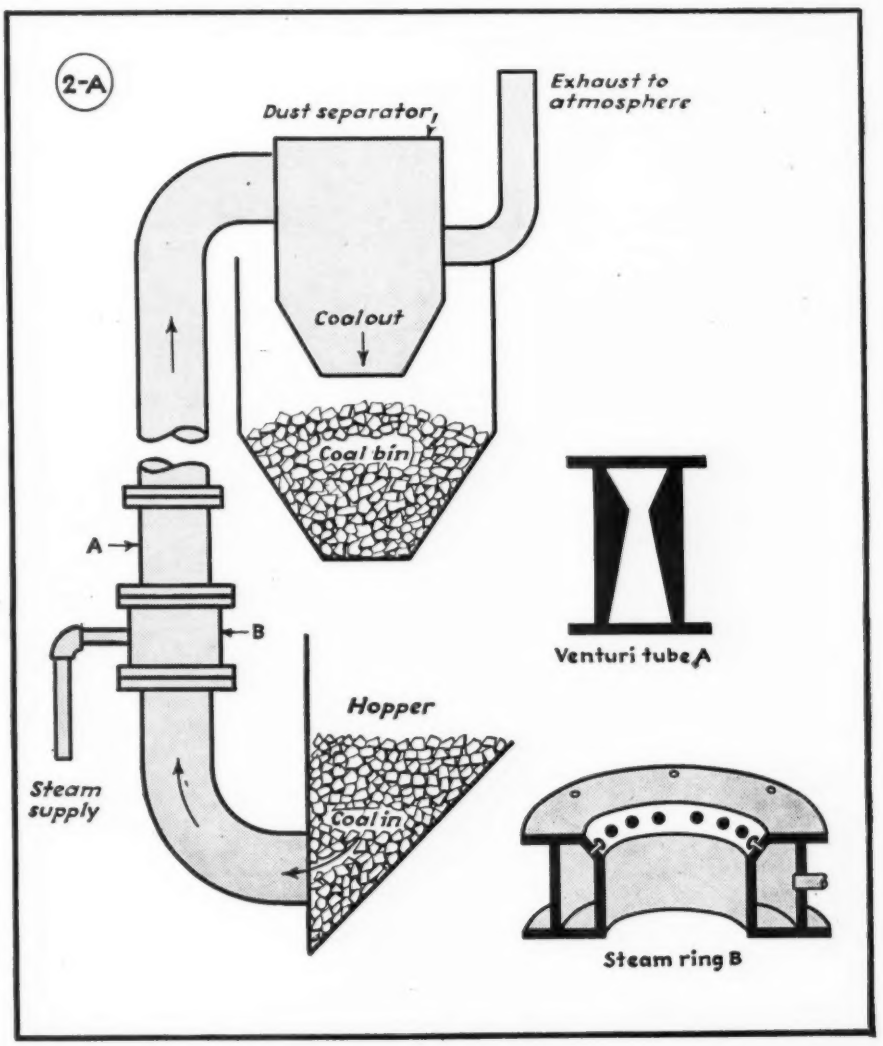
A PNEUMATIC OR STEAM JET CONVEYOR should be the best type for *JHL* to use on his coal-transfer problem. The system best suited for the service is shown in sketch 2-A. The venturi tube and steam-ring arrangements are shown in the inserts at *A* and *B*. The exact size of the jet and steam supply line would have to be determined by the manufacturer because the steam pressure is not given. Neither does *JHL* state the quantity of coal to be delivered. all of which should be clearly stated before purchasing his conveyor.

*Cincinnati, Ohio* E L HARTMAN

## Steam Jet Increases The Operating Costs

IF *JHL*'S JET CONVEYOR is intended for a small plant I believe he will find the operating costs too high. Steam used in this type of conveyor is, of course, wasted; therefore the steam consumption has to be made up in boiler water. If makeup water is treated, additional costs result. Boiler sludge also increases from the additional makeup water, which usually requires more boiler blowdown. First cost

(*Continued on page* 138)



# CENTRIFUGAL PUMP Q AND A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

# 13—Suction and Discharge Piping

*Thirteenth in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.*

*Q 1—Can suction-pipe design affect pump performance?*

A—Yes, in two ways. If suction pipe is too small, friction losses combined with static lift may cause a total suction lift greater than that on which a pump operates successfully. This reduces pump capacity by an amount depending upon the system characteristics or, in other words, "operating in the break" (POWER, Nov, 1945, p 142, Q 14).

Elbows and other fittings in the pump's suction line may disturb liquid flow at its suction nozzle and to the impeller. This commonly occurs with double-suction pumps when an elbow turns toward one side of pump, Fig. 1 to 3. On a horizontal-shaft double-suction pump, an elbow in the vertical plane pointing down or up can be used. If the elbow must be turned toward horizontal, use a special design with center baffle to guide the flow around it, or install a straight run of pipe, 3-pipe diameters or longer, between elbow and suction nozzle, Fig. 1.

*Q 2—What precautions are necessary in the design and location of suction-line inlets?*

A—They should be of design and proportions that have low friction losses and must be sufficiently submerged so that vortexes will not form and suck air into the pump. Use a bellmouth on the inlet of suction line to reduce inlet loss. On vertical lines locate the bellmouth far enough above the bottom and away from all walls of the suction well so flow to the bellmouth is not restricted. Place it far enough below low-water level to prevent whirlpools. Horizontal suction lines coming into a pit or tank horizontally do not generally involve flow restrictions but must be submerged enough to prevent sucking air.

Simple rules cannot be given that insure satisfactory suction inlets under all conditions. Even in apparently excellent layouts trouble may occur because of some unforeseen reaction in liquid flow. Then baffles must be installed or some design change made to correct the trouble. Vortexes, drawing air into the suction line, can frequently be stopped by boards or planks floated in the water surface around the suction pipe.

*Q 3—How should a suction line be constructed?*

A—The liquid should be delivered to the suction nozzle without disturbance and with sufficient absolute suction pressure to permit proper pump operation. If it operates with a suction lift the line must be airtight for the existing vacuum.

*Q 4—How can size of suction line be determined?*

(*Continued on page* 116)

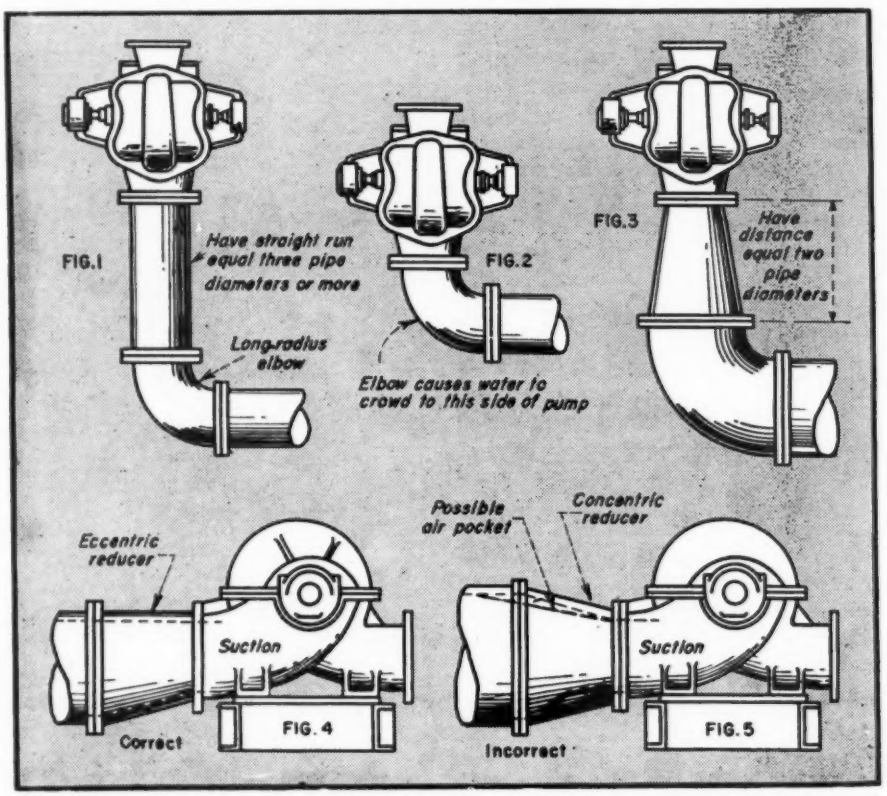
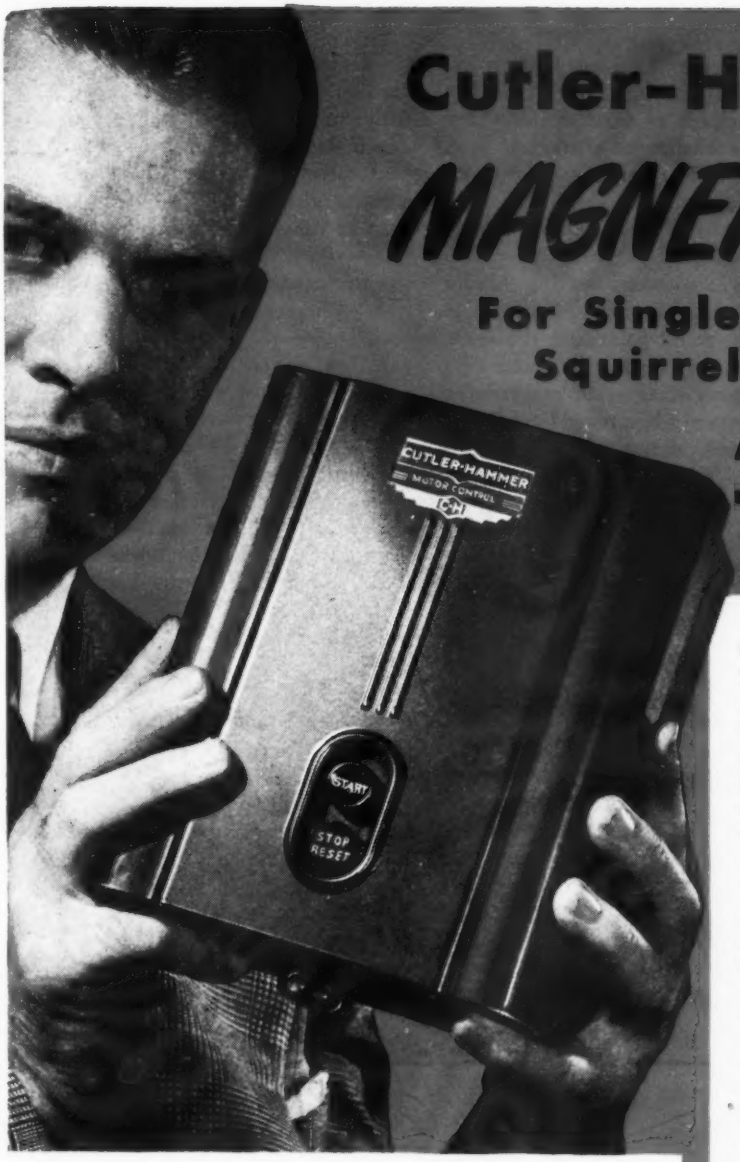



**Fig. 1 to 3—Horizontal long-radius elbow in suction line to double-suction centrifugal pump. If suction pipe is same size as pump nozzle, Fig. 1, place straight run equal to three pipe diameters, or more, between elbow and pump. Elbow at pump nozzle, Fig. 2, causes water to crowd to left side of pump. With reducer between elbow and pump, Fig. 3, make reducer's length at least two pipe diameters long. Fig. 4—Correct method, suction line connected to pump nozzle by eccentric reducer. Fig. 5—Do not use a concentric reducer as an air pocket may form in it**

# Cutler-Hammer 9586 MAGNETIC STARTER

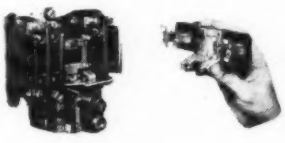
## For Single and Polyphase Squirrel Cage Motors

**An achievement resulting from the most intensive specialization in Motor Control history**

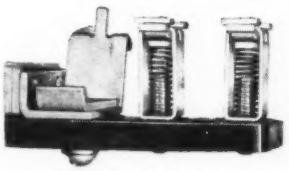



It can be no mere coincidence that the company oldest in specialized motor control experience is also the manufacturer of the famous 9586 Magnetic Starter. The Cutler-Hammer Vertical Contact design which plays so important a part in the outstanding performance of this small motor control unit came as a lesson learned, not among small a.c. motors, but in designing motor control for steel mill requirements. The renowned "drop of solder" overload relay, which protects your motor windings as no other relay can, was inspired by a clear understanding of operating needs. The 99-9/10% pure silver contact faces were selected because of their well-known immunity to oxidation. The same degree of *specialized* engineering is carried on throughout the design and manufacture of the 9586 Magnetic Starter. As a result, you get more work from your squirrel cage motors with full safety for your equipment at a minimum of expense, trouble and replacement in motor control. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

### Only years of experience can develop features like these



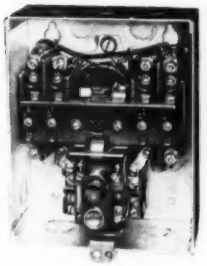
Vertical Dust-Safe Contacts. The famous Cutler-Hammer construction that assures better performance and longer life. Clean, cool, accessible contacts are the mark of better motor control.



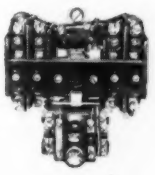
Heavy pure silver contacts result in new trouble-free performance in severe service. Lava insulators protect contact springs against even minor heat transmission, insuring full contact pressure *always* . . . an instantly accepted feature greatly extending the life of these working parts. Contact springs and contact supports now of stainless steel . . . a feature appreciated where corrosive atmosphere is a problem.

Famed C-H "Drop of Solder" overload relay has been further refined. New enclosed heater coil construction; new solder-alloy assembly easily and quickly removed for inspection. When an overload occurs, the red button pops forward, telling you at once why motor has stopped. Overload relay is free-tripping.

CUTLER-HAMMER
MOTOR CONTROL
C-H



Densheath internal wiring gives exceptionally workmanlike appearance. From the handsome modern cover to the beautifully finished light interior, advanced design is used throughout. Case has solid back. Mechanism rubber mounted on dead-back panel.



The C-H 9586 Starter is available in all standard constructions, with or without pushbuttons in case, with transfer switch, in combination starter, and in skeleton construction for built-in application.

# PUMP Q&A

*Continued*

A—Suction-line size depends primarily on the friction-head loss that can be permitted. Generally, on a pump operating with a suction lift suction-pipe size must be one or two pipe sizes larger than the suction nozzle. When pumps operate with a positive suction head, higher friction losses can be permitted and pipe may be of smaller size than when a suction lift exists.

*Q 5—Can the suction pipe be smaller than the pump's suction nozzle?*

A—Generally this pipe should be larger or at least equal in size to the suction nozzle. In certain rare instances, however, when circumstances require a pump to operate always at part normal-design capacity, it is permissible to use suction piping smaller than the pump's suction nozzle. Here the resultant increase in friction losses would have no appreciable effect on pump performance. However, provide a suitable increaser in the suction piping, located well away from the pump to avoid disturbances at its entrance.

*Q 6—Why are long-radius elbows used in suction-line piping assemblies?*

A—Because they have less friction loss than standard elbows. Flow through a long-radius elbow is more uniform and there is less chance of disturbed flow, which would affect pump performance.

*Q 7—What precautions should be taken in the design of a suction header supplying a number of pumps?*

A—When a common suction header serves a number of pumps, taper it so that velocities at all points are the same. Since this cannot always be done with commercial-pipe sizes some compromise may be necessary. Reducing laterals are generally most desirable for such a header, Fig. 6 and 7. A header of constant size with smaller outlets is not so good as one with reducing laterals but is often used in waterworks where the header is a loop with valves so any section can be isolated in an emergency. Even with the low velocities used for such installations, water distribution to the pumps is sometimes unequal.

*Q 8—Why are eccentric reducers used on suction lines?*

A—Eccentric reducers, Fig. 4, are used so that the top of adjacent sections of different sizes may be at the same elevation. Thus air pockets are avoided that may form when concentric reducers are used, Fig. 5.

*Q 9—Why do pump manufacturers caution against loops in suction lines?*

A—Because air pockets may form in them and affect pump performance adversely. It is possible to operate a pump with an upward loop in the suction line if the high point is vented through a vent valve to a vacuum system in which a lower absolute pressure is maintained than in the suction line at the loop.

*Q 10—Why are siphon suction lines sometimes used in the chemical industry?*

A—Tanks are often constructed with their outlets above the level of the chemical they contain. When necessary to pump from such a tank, the pump has to operate on a suction lift if placed at tank-top level. When there is no floor at the tank's top, the pump is generally placed on the floor adjacent to its bottom and a siphon suction line used, Fig. 8. Care must be taken to exhaust all air from the siphon and to make sure it is not broken. The liquid's vapor pressure and the siphon's maximum height have to be within limits that permit such operation.

*Q 11—When should screens be used in a suction line?*

A—They should be provided on any suction supply in which there may be foreign material larger than passes through the pump easily, or where this material is objectionable in the liquid. Screens vary with the kind, size and amount of material to remove. Sometimes in place of screens strainers are

(*Continued on page* 118)

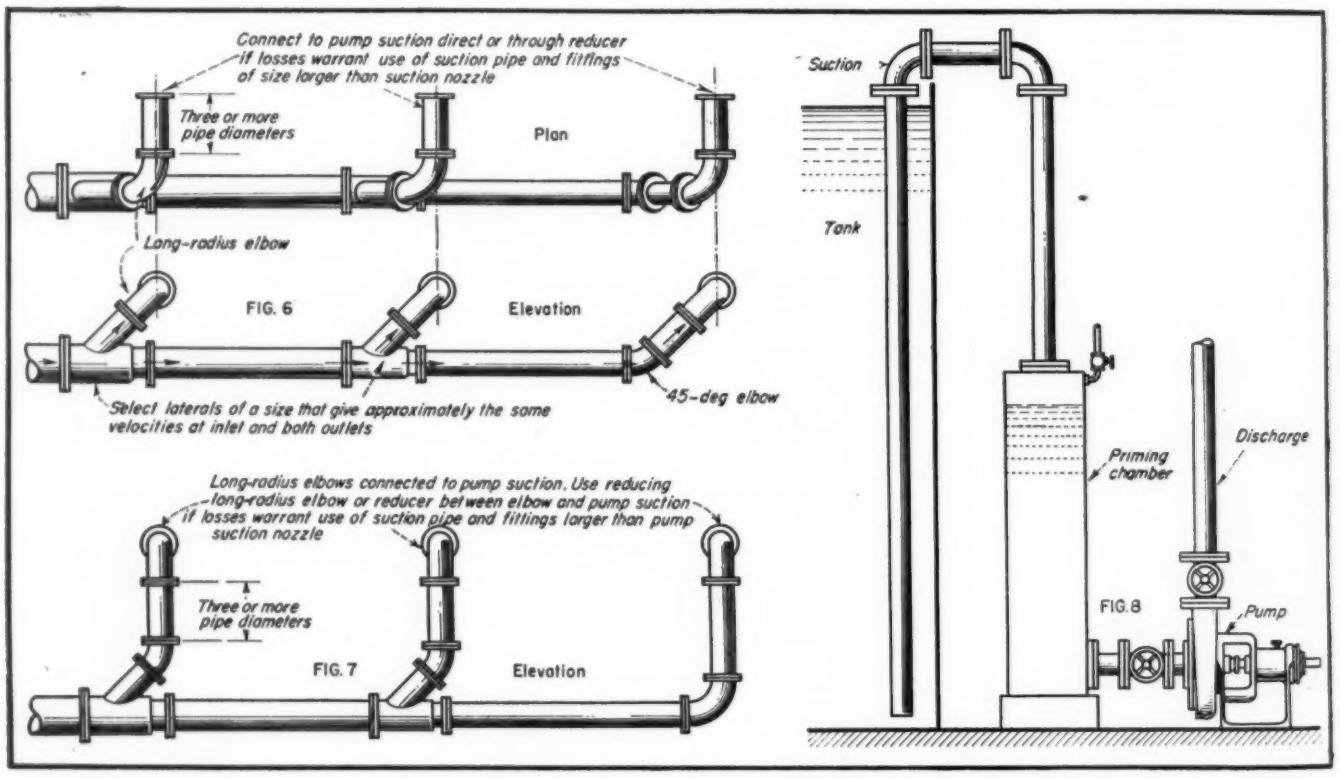

Connect to pump suction direct or through reducer if losses warrant use of suction pipe and fittings of size larger than suction nozzle
Three or more pipe diameters
Plan
Long-radius elbow
FIG. 6
Elevation
45-deg elbow
Select laterals of a size that give approximately the same velocities at inlet and both outlets
Long-radius elbows connected to pump suction. Use reducing long-radius elbow or reducer between elbow and pump suction if losses warrant use of suction pipe and fittings larger than pump suction nozzle
Three or more pipe diameters
FIG. 7
Elevation
Suction
Tank
Priming chamber
Discharge
FIG. 8
Pump

**Fig. 6—Recommended suction piping layout for several pumps using a common suction line. Fig. 7—Alternate suction piping for that in Fig. 6. Fig. 8—Siphon suction line used to draw from tank when on same level with pump**

# 22 YARWAY REMOTE INDICATORS SERVE AMERICAN VISCOSE

First they bought one . . . and it proved so satisfactory that now 22 Yarway Remote Liquid Level Indicators are on boiler room duty in four plants of this great rayon company.

That's the way the good word about Yarway Indicators is spreading. Plant after plant is finding that here at last is an instrument that gives safe, positive check on overhead water gages right down at convenient eye level . . . on a brilliant scale that is visible even in total darkness.

Yarway Remote Liquid Level Indicators are *accurate* because they are operated by the boiler water itself . . . by the pressure differential between a constant head of water and the varying head in the boiler drum. Indicating mechanism is perfectly balanced on jewelled bearings, and is never under pressure. Therefore, no stuffing boxes are required. Action is instant, constant, frictionless. Made for panel mounting or wall mounting, and suitable for all pressures up to 1500 psi.

Nearly 3,000 have already been bought for indicating boiler water levels, superheater pressure differentials, feed-water-heater levels and other liquid levels. Write for Bulletin WG-1821.

**YARNALL-WARING COMPANY**
**100 Mermaid Ave. Philadelphia 18, Pa.**

**YARWAY REMOTE LIQUID LEVEL INDICATOR**

## PUMP Q&A

*Continued*

used. While more accessible, they usually require frequent clearing and generally cause higher friction losses.

Even when screens are not necessary in normal operation, a temporary strainer is recommended in the suction line of a newly installed centrifugal pump. This strainer catches foreign material inadvertently placed in the piping, such as bolts, nuts and even a wrench or two that might damage the pump.

*Q 12—Why do some centrifugal pumps have vents on suction side of impeller?*

A—Hotwell pumps and some in process work handle liquids under absolute pressures corresponding to or near their vapor pressure. Under adverse operating conditions such pumps can become vaporbound. To prevent this, vents are provided on the impeller's suction side to vent vapors either back to suction source above liquid levels or to some suitable vessel.

*Q 13—Under what conditions does air, trapped in a volute casing top, affect pump operation?*

A—In most medium- and high-head centrifugal pumps, air trapped in their volute is washed out by the flow of water. With lower-head pumps and when air leaks into the suction line or through the stuffing boxes, this air is not washed out of the volute and remains to reduce pump capacity.

In certain applications, washing the air out into the discharge is objectionable. For instance, a boiler feed pump should not feed air into the feed system and it must be vented out of the pump casing.

*Q 14—What is the purpose of a check valve in the discharge line?*

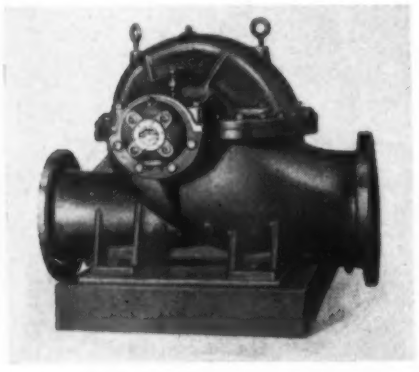


Fig. 9—Centrifugal pump with suction nozzle placed on side of pump casing

Fig. 10—When pump suction points downward it is a bottom-suction pump

A—In most installations a gate and a check valve are used between pump and discharge piping. Check valve prevents reverse liquid flow when the pump stops for any reason. Gate valve should be closed if the pump is shut down for an extended period to prevent leakage back through the check valve.

*Q 15—Are flap valves used with centrifugal pumps?*

A—Usual form of flap valve is a swing disk attached to the end of the discharge pipe. It serves as a check valve, and is used the same as a regular check valve, particularly in low- and moderate-head pumping installations discharging into a body of water, as a canal, near or adjacent to the pumping station.

*Q 16—Should a centrifugal pump be started with its discharge-gate valve open or closed?*

A—A centrifugal pump is generally started with the gate valve closed. It is opened after the pump is started, and the pump stopped after the gate valve has been closed. There is nothing objectionable in starting and stopping with discharge valve open unless system characteristics are such as to cause water hammer. Then it is often necessary to use check valves that open and close slowly.

With a high-specific-speed pump requiring high shutoff horsepower, its driver is frequently too small to start the pump against a closed gate valve. Such units are best started and stopped with the gate valve, if any, open.

*Q 17—How is the rotation of centrifugal pumps designated?*

A—According to the Hydraulic Institute Standards, rotation is clockwise or counter-clockwise when looking at the driven end of a horizontal pump and down on a vertical pump. Some manufacturers still designate rotation of horizontal pumps looking at its outboard end. Therefore, to avoid misunderstanding, clockwise or counterclockwise should always be qualified by the direction from which one looks at the pump.

*Q 18—What is meant by the inboard and outboard end of a pump?*

A—Inboard and outboard ends are applied to horizontal pumps. Inboard end is the one closest to the driver, while the outboard end is the one farthest away. In the case of dual-driven pumps, the terms lose their significance and are not used.

*Q 19—What is meant by inboard and outboard bearings?*

A—On horizontal pumps that have a bearing at each end, the bearing at the outboard end is known as the outboard bearing. Overhung impellers have both bearings on the same side of the impeller. On these the bearing nearest the impeller is the inboard and the one farthest away is the outboard. Generally on a double-suction pump with bearings on both sides, the thrust bearing is placed at its outboard end and the line bearing at the inboard end.

*Q 20—What is a side-suction pump?*

A—When the suction nozzle is placed on the side of the pump casing with its axial center line at right angles to the vertical center line of the pump, the pump is classified as a side-suction pump, Fig. 9.

*Q 21—What is a bottom-suction pump?*

A—When a pump's suction nozzle points vertically downward, the pump is called a bottom-suction pump, Fig. 10. Single-stage bottom-suction pumps are rarely made in sizes below 10-in. discharge size.

*Q 22—What is an end-suction pump?*

A—It has a suction-nozzle axis that coincides with that of the shaft or is parallel to it and on the pump's outboard end, Fig. 11. These pumps have their two bearings on their inboard side.

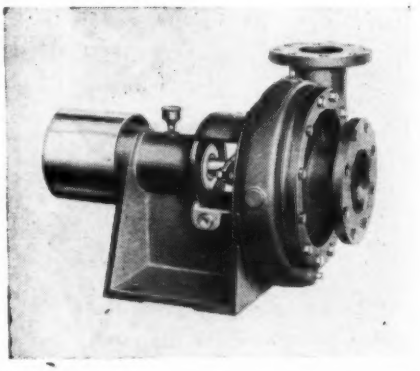
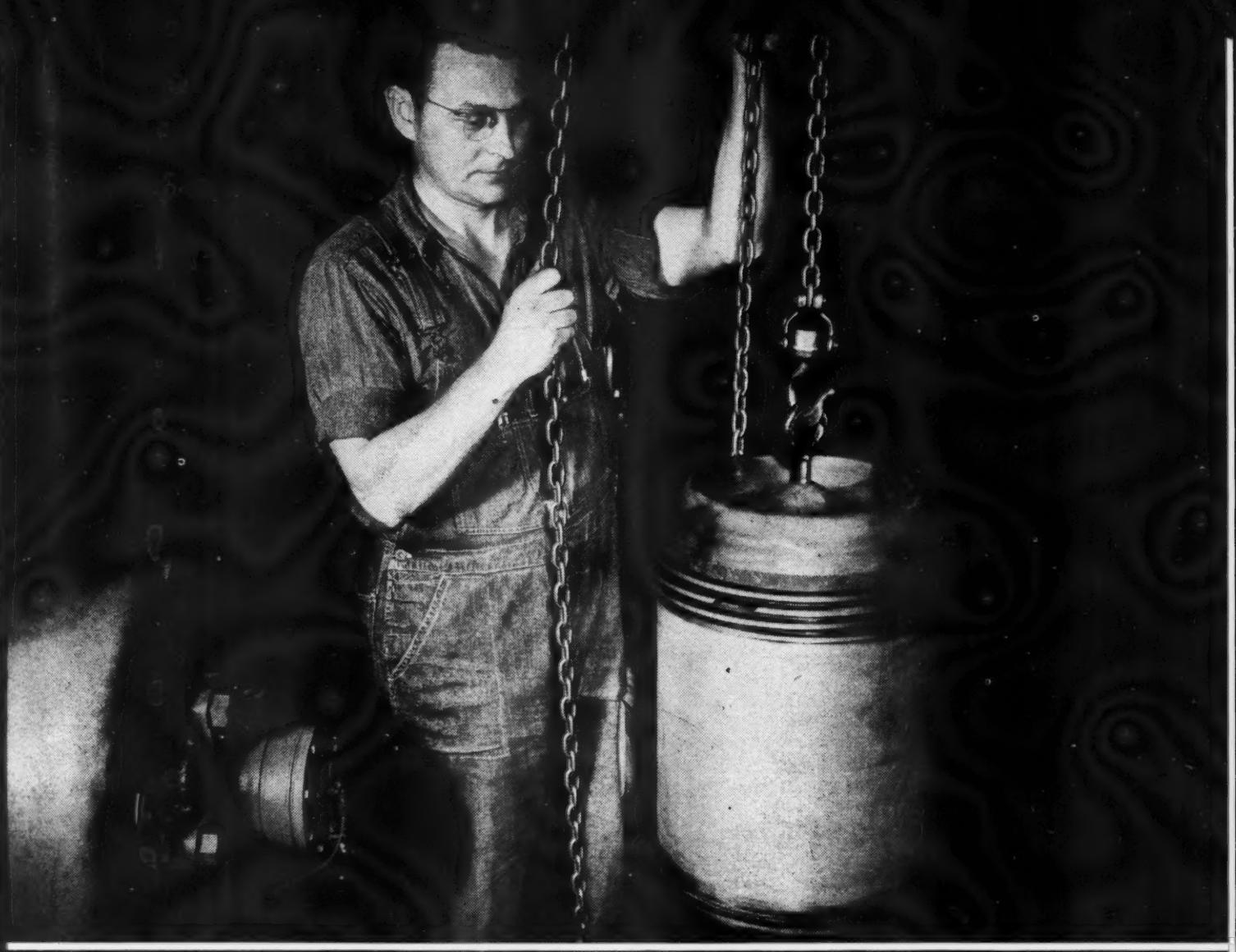


Fig. 11—In an end-suction pump, suction nozzle coincides with the shaft



# WEAR TAKES A HOLIDAY—*for 3 Years*

## SUN DIESEL LUBRICANTS . . .

### Keep Big Diesels Running Trouble-Free for Three Years in a Row

**The piston, shown above, is from one** of three 400-h.p. engines, installed in 1941, and just recently given its first major overhauling.

**Lubricated** with one of Sun's special Diesel lubricants, these engines were in almost continuous operation, day and night, supplying power for one of America's major war-plants.

**The perfect condition** of rings, liners, bearings, and other parts when inspected, is an outstanding testimonial to the lubricants chosen . . . no hard carbon, no stuck rings, no flinty or gummy deposits.

**For all types** of Diesel . . . for all types of power-equipment . . . choose the lubricants that will protect your equipment against wear, keep them operating at rock-bottom cost. Call the Sun office near you for full information.

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# MATH TIPS

**PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS**

## 10—Speedy Approximations

► THE ARITHMETICAL SHORTCUTS shown last month on this page were all exact. Equally useful to the engineer in many cases are shortcuts that give a reasonably close approximate answer in a few seconds. These can be particularly helpful when a rough answer must be obtained in a hurry and no slide rule or other mathematical aid is at hand.

When numbers to be multiplied or divided fall close to 1, 10, 100, 1000, etc, or to 0.1, 0.01, 0.001, etc, certain shortcuts are easily applied. Take a case where several numbers are to be multiplied and each falls within 10% of one of these powers of ten. This means that each number considered lies in one of the following groups:

| | |
|---|---|
| 0.9 to 1.1 | 0.09 to 0.11 |
| 9 to 11 | 0.009 to 0.011 |
| 90 to 110 | 0.0009 to 0.0011 |
| 900 to 1100 | etc |

Note by what percentage each number to be multiplied exceeds or falls short of the nearest power of 10. For example, the number 92 falls short of 100 by 8%; the number 0.00105 exceeds 0.001 by 5%; the number 957,000 falls short of 1,000,000 by 4.3%, etc.

Here is the rule for the approximate multiplication of a string of numbers of this sort:

*Replace the actual numbers by the nearest powers of ten, and multiply. Get the algebraic sum of the individual percentage variations. Apply this as a correction to the product of the powers of 10 to get the desired product.*

*Example:* Multiply (approximately) 106.2x0.943x0.00102x9860.

The product of the nearest powers of 10 is 100x1x0.001x10,000 = 1000.

Get the algebraic sum of the percentage variations as follows:

| *Number* | *Percentage:* | *Over* | *Under* |
|---|---|---|---|
| 106.2 | | 6.2 | |
| 0.943 | | | 5.7 |
| 0.00102 | | 2.0 | |
| 9860 | | | 1.4 |
| Total | | 8.2 | 7.1 |
| Net | | 1.1 | |

Therefore, the final product is 1000, increased by 1.1%. This gives 1011. Working the problem in the conventional way, we find the correct product to 4 significant figures to be 1007. Here, error is 0.4%. This procedure is a great timesaver.

*A modification can be used where most, but not all, of the numbers to be multiplied fall within 10% of some power of 10. In that case multiply the fitting numbers by this shortcut method. Then complete multiplication of the remaining numbers by usual methods.*

*Example:* 46x108.3x9.72x1.035 =?

First work out 108.3x9.72x1.035. Multiplying powers of 10 gives:

100x10x1 = 1000

Figure the percentage variations:

| *Number* | *Percentage:* | *Over* | *Under* |
|---|---|---|---|
| 108.3 | | 8.3 | |
| 9.72 | | | 2.8 |
| 1.035 | | 3.5 | |
| Total | | 11.8 | 2.8 |
| Net | | 9.0 | |

So 108.3x9.72x1.035 = 1000 + 90 = 1090, approximately. By ordinary multiplication to 3 significant figures, 1090x46 = 50,100. In this case, the exact answer to five significant figures is 50,118.

The engineer who would like to know just how far to trust such methods can soon find out by a little easy experimentation, using no numbers except 11 and 9, since these correspond to the worst possible cases, 10% over and 10% under.

Suppose there are two numbers, each 10% over:

| | *Exact* | *Rule* | *Error* |
|---|---|---|---|
| 11x11 | 121 | 120 | 0.8% low |

Suppose there are two numbers, each 10% under:

| | *Exact* | *Rule* | *Error* |
|---|---|---|---|
| 9x9 | 81 | 80 | 1.2% low |

Suppose there are two numbers, one 10% over and one 10% under:

| | *Exact* | *Rule* | *Error* |
|---|---|---|---|
| 9x11 | 99 | 100 | 1% high |

The foregoing demonstrates that when there are two numbers the only way to get an error above one percent is to have both numbers *under* by nearly the full 10% limit we have assumed.

Moreover, the 10% limit was arbitrarily chosen to make the rule cover a fair proportion of engineering problems. By closing in the limit to 5%, or less, a much higher degree of accuracy is assured.

The following examples show the maximum possible error for two and three numbers where none differs from the nearest power of 10 by more than 5%:

| *Number* | *Exact* | *Rule* | *Error* |
|---|---|---|---|
| 1.05x1.05 | 1.102 | 1.10 | 0.2% |
| 1.05x1.05 x 1.05 | 1.158 | 1.15 | 0.7% |
| 0.95x0.95 | 0.902 | 0.90 | 0.2% |
| 0.95x0.95 x 0.95 | 0.857 | 0.85 | 0.8% |

### *Approximate Division*

A similar rule applies to division where both numbers fall within 10%, or some other specified small percentage, of powers of 10. However, instead of using a separate rule for division, the following rule will cover any combination of multiplication and division.

*First write the problem in the form of a fraction. Then solve the fraction in powers of ten and apply a net percentage correction as before. The only difference is that the "overs" and "unders" are reversed for any numbers in the denominator.* These are marked (*) in the following example:

*Example:* 92.6 x 1.03 ÷ 0.982 x 923 ÷ 1.083 =?

First rewrite as a fraction:

$$\frac{92.6 \times 1.03 \times 923}{0.982 \times 1.083}$$

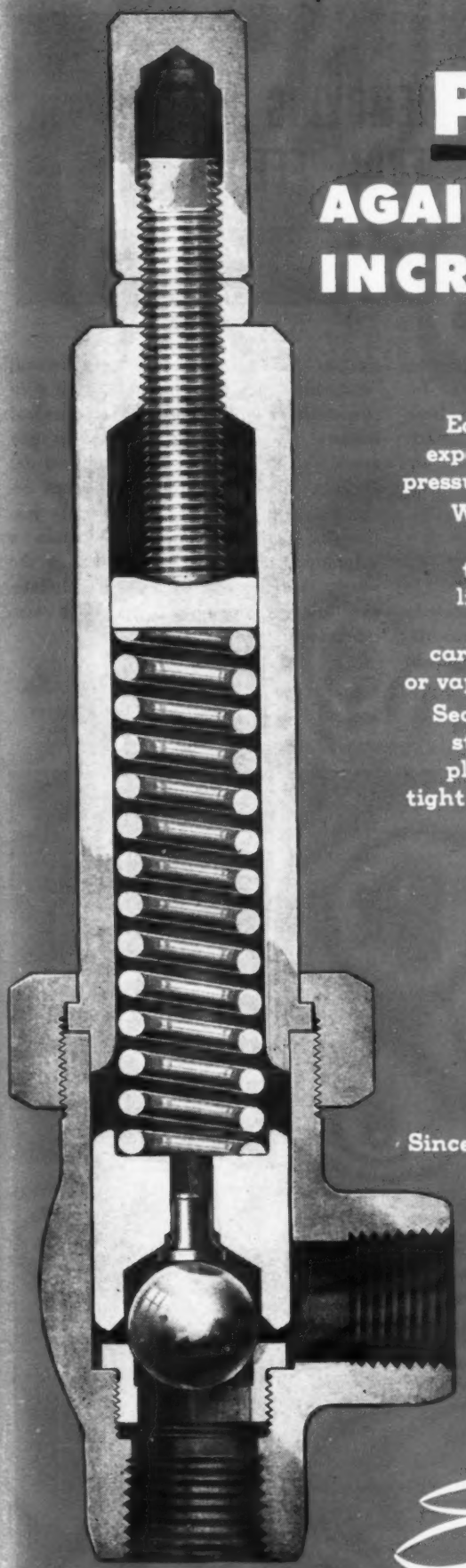
Solve for powers of 10:

$$\frac{100 \times 1 \times 1000}{1 \times 1} = 100{,}000$$

Next step is to figure the percentage variation, reversing the overs and unders for numbers in the denominator (*):

| *Number* | *Percentage:* | *Over* | *Under* |
|---|---|---|---|
| 92.6 | | | 7.4 |
| 1.03 | | 3.0 | |
| 923 | | | 7.7 |
| 982 | | 1.8* | |
| 1.083 | | | 8.3* |
| Total | | 4.8 | 23.4 |
| Net | | | 18.6 |

Finally, reduce 100,000 by 18.6 to give 81,400. Here the exact answer is 82,777, so the error is 1.6%.



# PROTECTION

## AGAINST SUDDEN PRESSURE INCREASES WITH EDWARD RELIEF VALVES

Economical Edward forged steel relief valves protect expensive equipment against sudden and dangerous pressure increases.

Widely used in power, chemical process, petroleum, hydraulic, marine and general industrial service, these relief valves are particularly suited for pump lines, drums, heat exchangers and unfired pressure vessels generally. Regularly available with either carbon or stainless steel springs, for water, steam, oil or vapor service.

Seat and ball disk are precision machined of EValloy stainless steel. The hardened stainless steel bearing plug gives point contact with the disk for quick and tight reseating after operation.

DIMENSIONS AND WEIGHTS—Fig. 141
Angle Relief Valve

| SIZE | ¼" & ⅜" | ½" | ¾" | 1" | 1¼" | 1½" | 2" |
|---|---|---|---|---|---|---|---|
| Center to End | 1½ | 1⅞ | 2⅛ | 2⅜ | 2¾ | 3⅛ | 3¾ |
| Center to Top | 6½ | 7¾ | 9¾ | 10⅛ | 12⅜ | 14½ | 16¼ |
| Weight—Lbs. | 2¼ | 4¾ | 6¼ | 13 | 19½ | 31 | 40 |

Valves in stock for relieving pressures up to 900 lb.

Since every valve is factory set for the required relieving pressure, orders should include information concerning service, frequency of operation, and relieving pressure. For data on other standard Edward globe and angle stop, check, gate, blow-off, non-return, feedline, gage and plug valves and strainers. Write for Catalog 103.

Edward Valves, Inc.

*Subsidiary of Rockwell Manufacturing Co.*

EAST CHICAGO, INDIANA

# WATER-TREATMENT QUESTION BOX

## REMOVING OXYGEN FROM FEEDWATER

By K M Herstein and John S G Shotwell

▶ REMOVING OXYGEN from boiler feedwater is a must. Here is a comparison of methods commonly used to do the job.

---

Goodwater Laboratory
Drum City, U. S. A.
Dear Chemist:

I understand sodium sulphite removes oxygen from feedwater. What are the advantages or disadvantages of this method compared to using a deaerator?

Yours truly,
Walter Tender

Dear Walter:

Combined with oxygen, sodium sulphite forms sodium sulphate. To complete the reaction oxygen is drawn or removed from the water, which increases the sulphate-caustic ratio. But deaeration by chemicals only is far more expensive than removing most of the oxygen by heating and using chemicals for final removal.

Like sugar and salt, free oxygen dissolves in water. No chemical combinations form, so physical means will remove dissolved oxygen. Unlike most solids, gases decrease in solubility with water-temperature rise: ice water contains 2.4 cu in. oxygen per gal; water at 50 F, 1.9 cu in.; at 70 F, 1.5 cu in.; at boiling, less than 0.03 cu in., Fig. 1.

If 70-F feedwater contains 1.5 cu in. oxygen per gal, or 8.55 ppm, 67.3 lb of chemical (sodium sulphite) is needed per million lb of water to remove this amount of oxygen by chemicals only. A 101-lb quantity of chemicals for every million lb of water treated would remove all dissolved oxygen in 40-F water. However, merely boiling the water removes all but a trace of oxygen. Removing this final contamination with chemicals requires less than 7 lb sodium sulphite per million lb of water.

Another important point to consider with oxygen removal by chemicals alone is the resultant dissolved solids. In 70-F water, dissolved solids increase by 75.8 ppm and 113.7 ppm for 40-F water, but only about 10 ppm with water first brought to boiling. First two examples show undesirable increase in solids. In boiling, the 10-ppm increase in dissolved solids is almost negligible. In a similar way, feedwater-treatment costs are high in the first two cases, low in the last. Assuming 10¢ a lb for sodium sulphite, treating 70-F water costs $6.73 per million lb, and 40-F water, $10.10, but for boiled water, less than $0.70.

As feedwater is usually preheated, using a simple deaerator with chemicals is economical and practical. With such a system most dissolved oxygen vents off through the deaerator so only about 0.1 cu in. per gal remains for chemical "mopping up." Considerable saving in chemicals results from such mechanical removal. Removing all dissolved oxygen mechanically requires a complicated deaerator, whose optimum performance demands close attention. A desirable feature is that the sulphite becomes a sulphate after absorbing oxygen in the water, which improves the sulphate-caustic ratio, and aids in reducing caustic-embrittlement danger.

Yours truly,
Chemist
Goodwater Laboratory

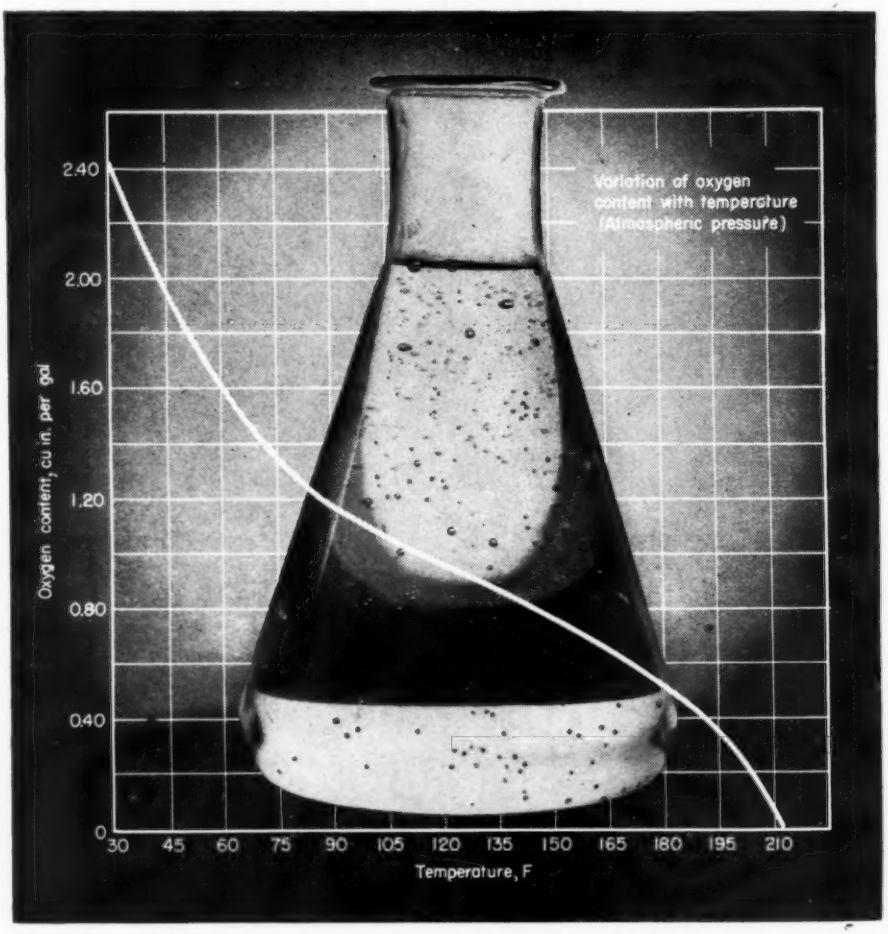



**Fig. 1—Oxygen is more soluble than nitrogen so the mixture released by boiling is usually richer in oxygen than air. Amount dissolved depends on temperature**

# "Spotlight" on Better Heating

"Spotlight" on the Webster Moderator system —the system that gives you adequate temperature on cold days; that limits the heat on mild days; that uses only the necessary amount of fuel—and that does it all automatically!

The Webster Moderator System of Steam Heating is "Controlled-by-the-Weather". An Outdoor Thermostat automatically balances the delivery rate of steam to each radiator so that it agrees with changes in outdoor temperatures.

The Webster Outdoor Thermostat automatically changes heating rate when outdoor temperature changes.

## More Heat with Less Fuel

Seven out of ten large buildings in America (many less than ten years old) can get up to 33 per cent more heat out of the fuel consumed! . . . If you are planning on a new building or on the modernization of an existing building, you will be interested in "Performance Facts"—a book of case studies, *before* and *after* figures, on 268 Webster Steam Heating Installations. Write for it today. Address Dept. P3.

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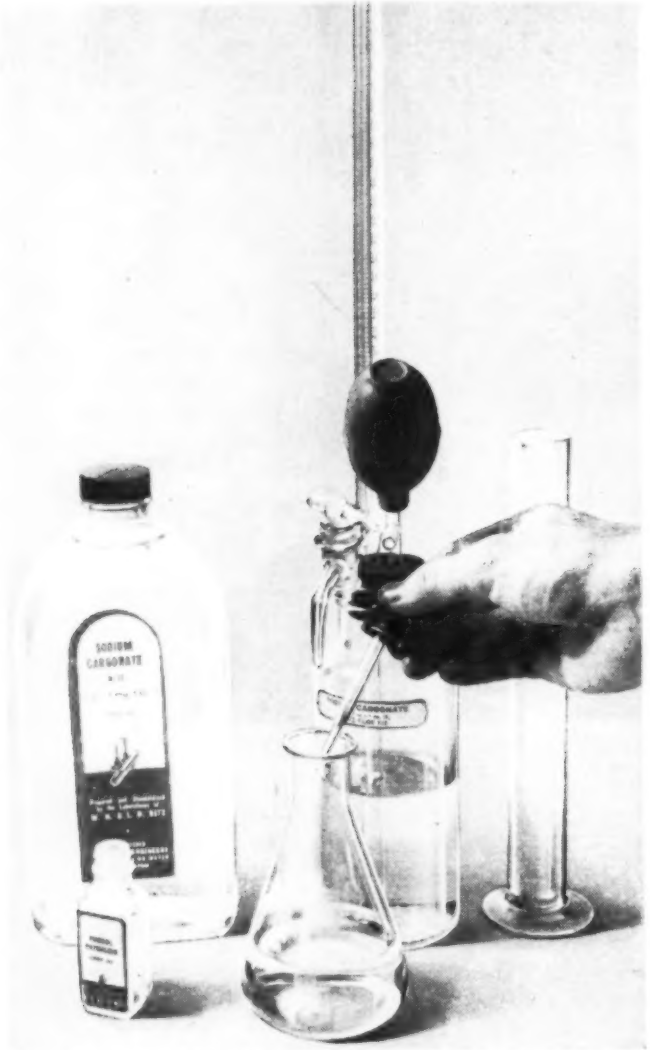
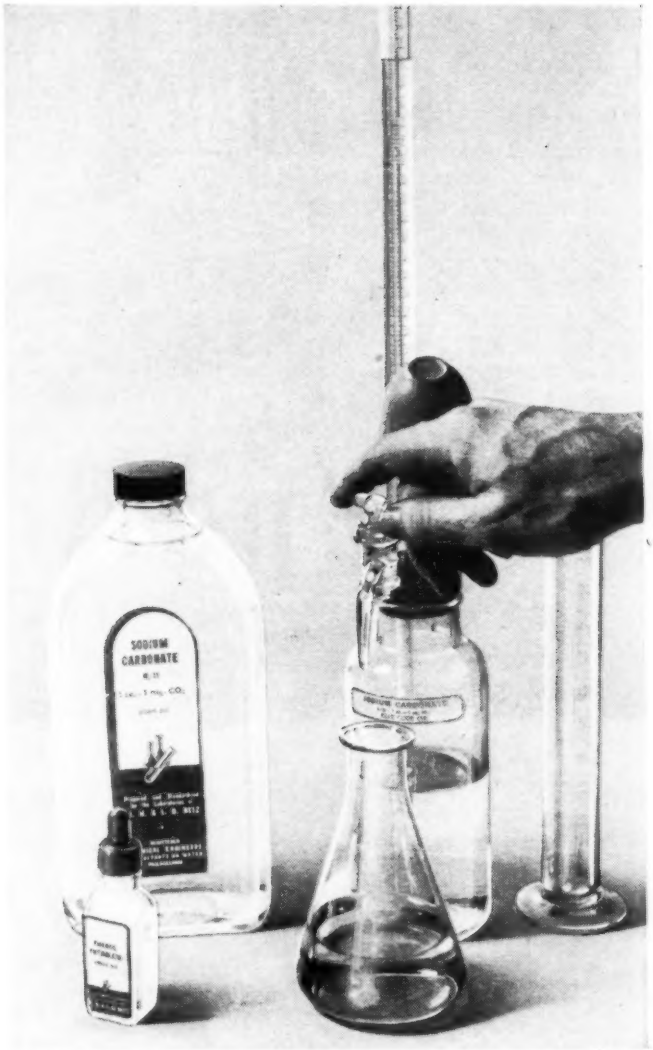
AUTOMATIC Webster Heating Systems

# HOW TO TEST FOR FREE $CO_2$ IN BOILER WATER

By C A NOLL, *chief chemist, W H and L D Betz*




**1** **Measure a 100-ml sample in a graduate and transfer to a 250-ml Erlenmeyer flask. Add 5 to 10 drops of phenolphthalein indicator. If sample turns red, no free carbon dioxide is present; if it remains colorless continue test.**




**2** **Titrate sample with N/22 sodium-carbonate solution, swirling the flask during the titration until a definite pink color develops throughout the solution, which is permanent for 30 sec. Take this as the endpoint of test.**

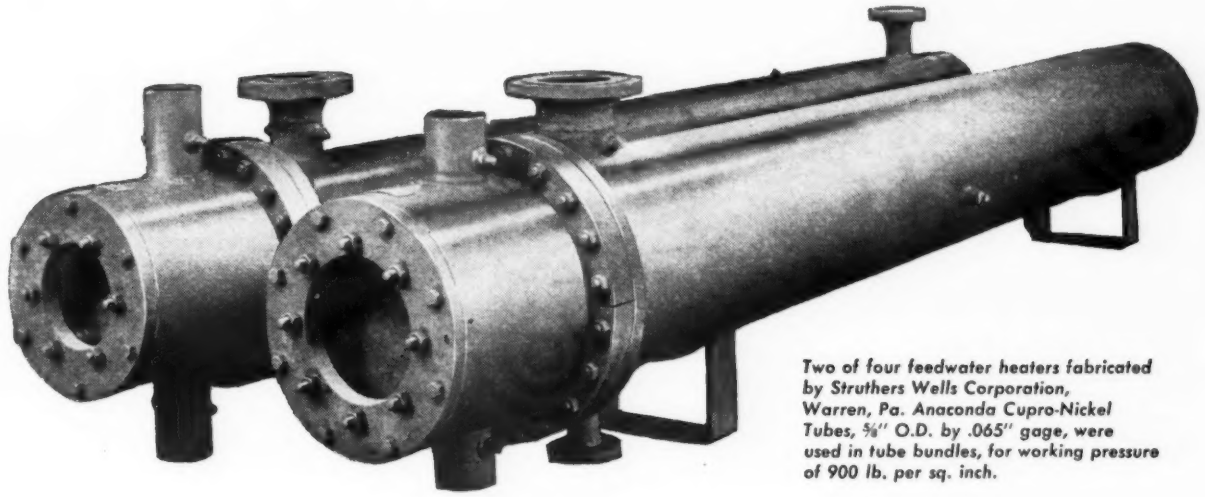
► ALTHOUGH SURFACE WATER usually contains only a relatively small amount of free carbon dioxide, well water sometimes carries an appreciable quantity. And even though makeup water is not contaminated, appreciable concentrations of carbon dioxide may be present in the steam and returning condensate because heat decomposes carbonates and bicarbonates present in the feedwater, and liberates free carbon dioxide.

Principal difficulty with this gas is that it ionizes on solution in water and forms carbonic acid, a highly corrosive substance. This reaction also lowers the water's pH and if oxygen is present its corrosive effects are enhanced. Thus piping, valves, heat exchangers and other apparatus are severely damaged. Amount present can be determined by the test outlined above. Take sample carefully to prevent escape of carbon dioxide.

The test is based on the fact that carbon dioxide reacts with sodium carbonate to form bicarbonate, which is colorless to phenolphthalein. As soon as an excess of sodium carbonate is present, a light red color develops which is taken as the endpoint.

Calculation of results: ml of N/22 sodium carbonate used $\times \frac{1000}{\text{ml sample}}$ = ppm free carbon dioxide as $CO_2$.

Limitations of test: Free mineral acid, if present, is measured; iron and aluminum salts interfere. Some carbon dioxide may be lost while taking the sample and during titration. For very accurate results use evolution (laboratory) method.



*Two of four feedwater heaters fabricated by Struthers Wells Corporation, Warren, Pa. Anaconda Cupro-Nickel Tubes, ⅝" O.D. by .065" gage, were used in tube bundles, for working pressure of 900 lb. per sq. inch.*

# Tubed with CUPRO-NICKEL for HIGH Pressures and HIGH Water Velocities

THESE FEEDWATER HEATERS were fabricated by the Struthers Wells Corporation for power plant service. The tube bundles (not shown) were hairpin bend U-tube units and the tubes selected were Anaconda Cupro-Nickel.

High pressures, high water velocities and thin tube wall provide a high rate of heat transfer. The tube alloy must accordingly possess good resistance to erosion and corrosion, and also high strength at relatively high temperature.

Four units were constructed and installed in pairs. The first installation has given six years service without any indication of tube deterioration.

Anaconda Condenser Tubes are made by The American Brass Company in 11 standard and several special alloys. Equipment fabricators and users are invited to utilize the broad experience and metallurgical knowledge of our Technical Department in selecting the most suitable alloy for their needs.

46172

ANACONDA

*Anaconda*

**CONDENSER TUBES**

**THE AMERICAN BRASS COMPANY**

General Offices: Waterbury 88, Connecticut

*Subsidiary of Anaconda Copper Mining Company*

*In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

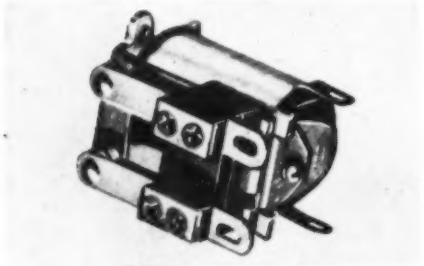
# WHAT'S NEW IN PLANT EQUIPMENT

## Diesel Engine

SUPERCHARGED DIESEL ENGINE, 7 cylinders, develops 633 hp at 600 rpm and produces 400 kw of electrical power. Cylinder bore is 10½ in., stroke 12 in. Engine is 28x7x9 ft high. It is complete with supercharger, generator, switchboard, starting tank and alarm system, which protects the engine from damage if cooling water or lubricating oil fails. **Buckeye Machine Co, Lima, O.**

## Air-Flow Indicator

FLOCATOR, an air-flow indicator, gives percentage of maximum flow at all times. It warns against any air-flow loss in a ventilating system, thus preventing circulation loss. Model 45 is for small-capacity ventilation and Model 75 for large-capacity systems. **Dollinger Corp, Rochester 3, N. Y.**



## Control Relay

CR CONTROL RELAY is said to combine compactness and light weight with dependable switching. Contacts are ¼ in. in dia and are generally supplied in silver although alloy contacts are obtainable. CR relay is in two, three and four pole combinations and, if desired, hermetically sealed. Contact rating with ¼-in. silver contacts is 15 amp at 24-v dc or 110-v ac, non-inductive. The single-pole CR relay weighs 3 oz, is $1\frac{33}{64}$ ft high, $1\frac{5}{32}$ in. wide and $1\frac{23}{32}$ in. long. A variety of contact combinations are available in all CR models. **Allied Control Co, 2 East End Ave, New York 21, N. Y.**

## Dielectric Heater

NEW STANDARD 2-kw (output) dielectric heater operates on a frequency of 27 megacycles. Frequency may be varied through a wide range by a front-panel control; an automatic timer controls heat sequence from two sec to 20 min as selected. An oven, containing electrodes easily set for any desired application, is completely shielded to eliminate undesirable radio-frequency radiation. Filament of a long-lived oscillator tube with simplified forced-air cooling is protected by a time-delay relay. Added protection is provided by an overload plate-current relay. **Allis-Chalmers Mfg Co, 612. Milwaukee 1, Wisconsin.**

## Flexible Tubing

SEAMLESS FLEXIBLE TUBING in stainless steel has been developed by company. One end of tubing in photo above shows deep helical convolutions in cross-section; the other end illustrates an integral cylindrical extension suitable for attaching flare fittings. Flexible tubing shown is usually provided with metallic braid jacket to take care of internal-pressure requirements. Any kind of end connection may be furnished. Standard sizes range from $\frac{1}{16}$ to ¼ in. ID, inclusive. Larger sizes are in preparation. **Seamlex Co. 27-27 Jackson Ave, Long Island City, N. Y.**

## Liquid-Meter Valve

EXCELLENT PERFORMANCE of gasoline metering valve shown below can be maintained, according to maker, at 850 F. Valve is also said to have shear strength to 10,500 psi, compressive strength to 52,000 psi and tensile strength to 4000 psi. Valve frequently seals across four or more pressure differential bands without trouble. It functions against zinc-base alloy, aluminum, cast iron or bronze. **Morganite Brush Co, 3304 48th Ave, Long Island City 1, N. Y.**

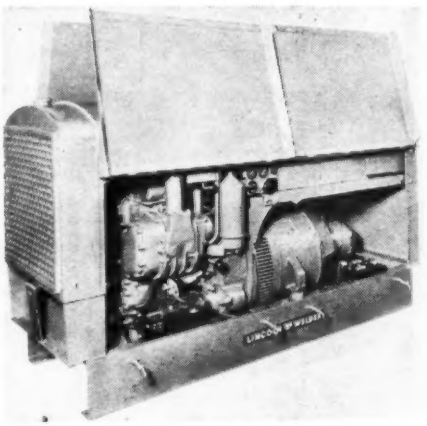
## Air Conditioning

ANEMOSTAT AIR-DIFFUSER not only eliminates drafts, but is also said to equalize temperatures inside air-conditioned inclosures to within ½ of 1 F, if necessary. Humidities are consequently equalized within corresponding limits.

*Anemostat* distributes air of any duct velocity in a multiplicity of strata traveling in all directions. Simultaneously, unit creates a series of counter-currents which siphon into the device room air equal to about 35% of volume of supply air. This room air is mixed with supply air in diffuser before air mixture is discharged into room. Velocity of discharged air is instantly reduced by air expansion in the device. **Anemostat Corp of America, 10 E 39th St, New York 16, N. Y.**

## Magnetic-Disk Brake

FOR APPLICATIONS up to 100 hp motor-driven loads, Series 1300 magnetic-disk brake can be supplied in floor or motor-mounted designs and for ac or dc. Simplified design provides easy replacement of any part without disturbing brake assembly. All that is necessary for motor mounting is suitable end plate. **Stearns Magnetic Mfg Co, Milwaukee 4, Wisconsin.**



## Diesel-Driven Welder

POWERED BY A 2-CYCLE DIESEL engine, welder is for locations where electric power is neither available nor economical. Equipped with dual continuous control, welder permits operator to select any arc and arc intensity. Welding generator has NEMA rating, 300 amp at 40 v. Current range for welding duty is from 60 to 375 amp, 20 to 40 v. This welder is said to cut fuel costs substantially. **Lincoln Electric Co, 12818 Coit Rd, Cleveland, O.**

## Drying Unit

GASFLUX 636 SERIES DRYER removes moisture from air lines and gas lines. Construction of dryer consists of an outer shell of 6-in. OD seamless steel tubing and a removable inner shell or cartridge of rolled sheet metal having a perforated metal bottom. A cast bronze head with inlet and outlet openings is bolted

# CRANE

NEW

NEW

## PRESSURE-SEAL BONNET VALVES

**A new line . . . a basically different design . . . of welding end gate, globe and angle, and automatic stop check valves . . . featuring new adaptability to high pressure and high temperature services . . . in pressure classes up to 1500 pounds.**

Here you see the latest advance in on-the-job valve efficiency . . . the Crane Pressure-Seal Bonnet principle. Note the absence of the customary flanged bonnet joint. The joint is inside . . . automatically sealed by pressure in the valve. Bonnet joint leakage and maintenance are eliminated.

The lighter weight of these valves . . . 40 to 60% . . . and greater compactness over conventional designs, reduces handling and piping erection costs. Their streamlined construction includes new achievements in straight-through flow . . . smooth operation . . . and trouble-free performance.

Extensive field tests under severe working conditions record the all-round superiority of Crane Pressure-Seal Bonnet Valves. We'll be glad to give you all the facts. CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas*

SIMPLIFIED YOKE—Valve is firmly mounted on body with simple clamp. Forces required to operate valve are transmitted direct to body.
PRESSURE SEAL BONNET JOINT—Pressure of fluid seals this new Crane bonnet against leakage. Conventional flanged joint is eliminated.
EASE OF INSPECTION—New simple construction of Pressure-Seal Bonnet. Opened and re-assembled in far less time than flanged bolted bonnet.
LIGHTER WEIGHT VALVES—Compactness of design permits 40 to 60% weight saving. Conserves space; simplifies piping erection and suspension.
FULL LENGTH DISC GUIDE—Close fit machined guide insures true disc travel all the way. Full guiding where needed—near point of seating.
BETTER INSULATION Streamlined exterior design makes application of insulation easier, saves time and material; gives
NEW FLEXIBLE WEDGE DISC—Built-in flexibility keeps disc from sticking. Self-adjusting to temperature changes in valve body and pipe line stress.
NEW TYPE BODY SEAT RINGS—Permit straight-through flow with minimum friction. Rings are welded-in. Stellite facing insures highest wear resistance.
CRANE STEEL

*(Cross-section and exterior of 8 in. 1500-pound gate pattern.)*

PATENTS
2029606
2060078

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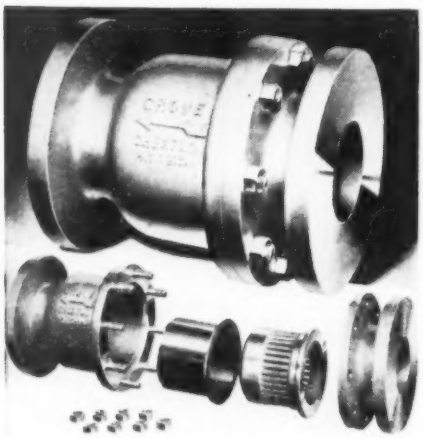
VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

# CRANE

*FOR EVERY PIPING SYSTEM*

to a flange welded to outer shell. Incoming gas or air must first pass downward between inner and outer shell, thus trapping entrained moisture, and then passes upward through drying medium to full cartridge length to reach outlet valve. Depending upon drying efficiency that is required, there is a choice of three drying media to be used in the cartridge. These are *Fiberglas*, calcium chloride and activated alumina. **Gasflux Co, Mansfield, O.**



## Check Valve

OPERATION OF GROVE CHEXFLO valve is by a synthetic-rubber tube, stretched over a slotted, cup-shaped metal core, which expands to open and contracts to close. Flexible tube possesses a uniform and constant spring rate, according to maker, which avoids inertia being set up to cause operation beyond flow requirements. Unit handles highly corrosive and erosive air, gases or liquids. **Grove Regulator Co, 6547 Green St, Oakland 8, Calif.**

## Air Separator

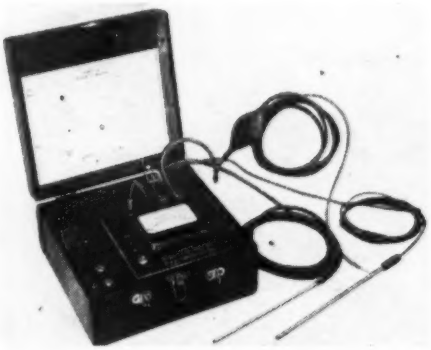
AIRFUGE, A NEW SEPARATOR for removing moisture, oil, scale, etc, from compressed air, utilizes the centrifugal principle. Air entering inlet is diverted positively to inner wall of the round body and unwanted substances whirl out of the air stream and drain to bottom. Cleaned air may be taken off horizontally or vertically from pipe-tapped ports. An integral float-operated trap releases condensate automatically. Separator is made of high-tensile iron; interior parts of corrosion-resisting materials. Bottom is easily removed for cleaning. Separator is made in three sizes for varying capacities and with a range of pipe-connection sizes. **Swartwout Co, 18511 Euclid Ave, Cleveland 12, O.**

## Cylinder

STANDARDIZED CYLINDER, for operation by air, oil or water, lends itself to almost universal mounting applications. It is available in an assortment of diameters and stroke lengths that are said to meet practically all requirements. **Engineering Products Co, Los Angeles, Calif.**

## Stack-Analysis Instrument

SMALL, PORTABLE STACK-O-METER indicates $CO_2$ stack temperature and draft readings. All readings are taken on one meter. $CO_2$ percentage readings are obtained from gas samples collected through a hand aspirator bulb. Stack temperatures are read on the same dial, obtained electrically from a thermocouple mounted in gas-sampling tube. Draft measurement is obtained through a separate tube, but read on same meter. Meter



dial reads 0 to 20% $CO_2$ in black figures, temperature on a red scale 0 to 1000 F, and draft in tenths of inches of water on a green scale. Safety switch automatically shuts off battery current on closing of instrument box cover.

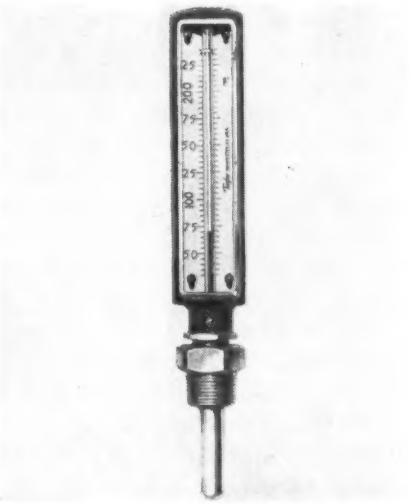
Electrically operated, only maintenance is that of an occasional replacement of batteries, which are of standard flashlight design. Accuracy of *Stack-o-meter* is based on thermal conductivity principle of analyzing gases by an electrical Wheatstone bridge circuit. **Davis Emergency Equipment Co, 45 Halleck St, Newark 4, N. J.**

## Flexible Ducts

MULTI-FLEX DUCTS are light, durable and easy to install. They can be twisted and turned around obstructions. If accidentally crushed these easily repaired ducts resume normal shape as soon as pressure is released. They withstand temperatures up to 350 deg F and down to 70 deg below zero. They are made of glass and asbestos fabrics impregnated with synthetic rubber and plastics. No wire reinforcements are employed. Flexibility is obtained by corrugations. **United States Rubber Co, Rockefeller Center, New York, N. Y.**

## Jewel Bearing

NEW JEWEL-BEARING ASSEMBLY for D'Arsonval instruments has been developed. It is composed of a metalized boro-silicate glass-V jewel, which is induction-soldered into place with special electronic equipment. Through its use, over-all size of bearing assembly is said to be considerably decreased. **Marion Electrical Instrument Co, Manchester, New Hampshire.**



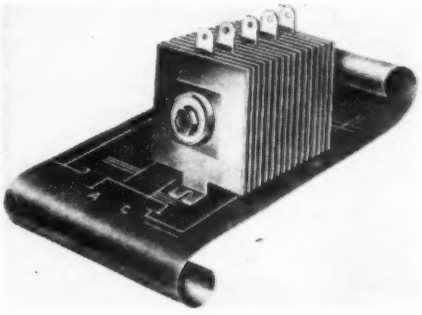
## Industrial Thermometer

STURDY, VERSATILE 5-in. mercury-in-glass thermometer is used where space is limited and instruments are subjected to unusual vibration. It is considered ideal for such applications as diesel engines, air compressors, lubrication-oil lines on motors, generators, reduction gears, and small-diameter brine, water and steam lines. There are a variety of stem forms: straight, 90-deg angle, 90-deg right-side angle, 90-deg left-side angle, or 45-deg reclined (135-deg oblique) angle. Ranges available are —40 to +110 F, 30 to 180 F, 30 to 240 F and 200 to 500 F. **Taylor Instrument Companies, Rochester 1, New York.**

## Metallic Rectifier

DRY-DISK COPPER-SULPHIDE RECTIFIER does not require forced cooling. Rectifier is rated 50 amp for 6-v automotive-battery taper charging. Two rectifiers may be operated in parallel from separate transformer secondaries to provide 100-amp maximum charging

(*Continued on page* 142)



# WET COAL CAN'T CLOG THIS Æ STOKER

**NEW FEATURES UNVEILED AT 17th BIRTHDAY PARTY**

Streamlined dress, simplified operation, improved coal distribution, positive non-clog feed—these are the products of growth proudly presented on the Perfect Spread Stoker's 17th anniversary—a hard-earned tribute to long, economy-proved service in 15 types of industries.

AND THIS is no idle claim. Not *one* complaint of clogging by wet coal has ever been received from our many users.

The Æ Perfect Spread Stoker will feed and burn coal wet or dry, fine or coarse without clogging. It is the only spreader stoker with a travelling conveyor feeder and safety feature that *guarantees* non-clogging *regardless of the size or condition of coal used!*

Every plant has wet coal at some time. End *your* wet coal troubles. Decide today in favor of lower steam costs and cleaner, more efficient boiler room operation with the Æ Perfect Spread Stoker. Write at once for the Æ Perfect Spread Stoker bulletin.

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## PERFECT SPREAD STOKER

WITH STATIONARY GRATES, DUMPING GRATES OR CONTINUOUS ASH DISCHARGE —UP TO 400,000 LBS. OF STEAM PER HR.

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# POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION • FUEL CONSERVATION

## Power Construction By Reclamation Bureau

► This year Reclamation Bureau starts construction on a $140,000,000 program of new dams, power plants, transmission lines and irrigation projects, most of them started before and delayed during the war. Thirty projects will be resumed or begun with (1) funds made available in the regular 1946 appropriation bill (2) another $81,462,000 set apart in the recently enacted deficiency bill and (3) funds available as carryover from unexpended appropriations.

Three dams, two of them with power plants, and about 300 miles of transmission lines, all part of the joint Army Engineers' Bureau of Reclamation plan for development of the Missouri River Valley, are among the projects scheduled. They are the Boysen Dam and power plant on Wyoming's Big Horn River; Kortes Dam and power plant, on Wyoming's North Platte River; and a 150-ft concrete dam on Cheyenne River near Hot Springs, S. D., to provide irrigation water for the Angostura project. Bureau of Reclamation will also build transmission lines from Fort Peck Dam, in Mont., to Williston, N. D., to provide construction power for Garrison Dam project, which the Army Engineers will start this year. Garrison is also part of Missouri River development plan.

Eight other Missouri Basin projects authorized for the Reclamation Bureau will be started this year if Congress appropriates funds for them. Included in this group are the Canyon Ferry project, in Mont., where a 35,000-kw plant is under study; Glendo project, in Wyo., where a 10,000-kw plant is proposed, Bostwick project, in Kan., where a 2000-kw plant is proposed, and Heart River project, in N. D., where a small plant for irrigation pumping only is under study.

Work on Columbia Basin project, the irrigation subdivision of the Grand Coulee dam project, will include clearing of land and some work at Grand Coulee itself, where two turbines are being removed and three are under construction.

Farther south, work on California's Central Valley project will be pushed after some years of delay because of wartime restrictions. Included in projected work on this development is construction of a 230-kv transmission line from Oroville, Calif., to Sacramento and a short, inter-substation tieline there, as well as the installation in Shasta Dam of two units now being removed from Grand Coulee.

Bids for construction of Davis Dam, on the Colorado River, are expected to be let shortly, to bring another Reclamation project under construction.

Other power projects and funds proposed for their power features in 1946 regular and deficiency appropriation bills are as follows:

Parker Dam, on the Colorado River in Arizona; Colorado-Big Thompson project in Colo., $3,625,000; Boise project, Idaho, Payette div, $624,000, Anderson Ranch div, $643,000; Palisades project, Idaho, $20,000; Hungry Horse project on south fork of Flathead River in Mont. (No funds for power were appropriated, but they were made available for dam construction.); Rio Grande project, N. M., $138,000; Deschutes project, Ore., $288,000; Kendrick project, Wyo., $630,000; Shoshone project, Wyo., power div, $900,000.

## Rich Midwest Power Conference Program

Beginning with its opening session, Wednesday, April 3, 1946, the Midwest Power Conference at the Palmer House, Chicago, has scheduled a 3-day program "loaded" with subjects of top interest to men in the power field.

At this opening meeting the tone of the conference becomes apparent. A paper on atomic energy by P W Swain gives merited attention to this all-important new power concept. Following on this same session comes a discussion

(*Continued on page* 166)

## PUBLISHER OF 'POWER' TOURS BRITISH INDUSTRY

**At one of a series of conferences with leading manufacturers of Great Britain, N O Wynkoop, publisher of POWER, discusses merchandising boiler mountings, steam fittings and valves with Dewrance & Co, Ltd. Founded in 1844 by John Dewrance Sr, early railway pioneer and erector of Stephenson's locomotive, "Rocket," Dewrance introduced babbitt bearings in England and rates among Britain's best in valve manufacturing. The company maintains close connections with many American firms. Seated, l to r: W H Crowest, secretary; J H Gibson, deputy chief engineer, C Armstrong of Copes Regulators; T G H Parker, works manager; J M Storey, managing director; F F H Halestrap, director and chief engineer; H McNeil, director; J W Plowman, sales manager. Standing: N O Wynkoop; H Forbes White, chairman; G W R van Lennep, director, "Econosto" Rotterdam; W G Suffield, director; R W Lone, architect**

# no—

## it is not necessary to replace water lines like this!

. . says M. F. Ruley

Nalco Representative
Denver, Colorado

Down to 10% of capacity and full of rock-like scale! This water line was practically useless until it was cleaned out and kept clean by Nalco Stabilization Treatment. Obviously, there is no need to make expensive replacements when the Nalco System can be used to give you permanently scale-free lines so economically.

And scale elimination is only one phase of the complete Nalco System of scientific water treatment for all industry. A complete Nalco survey report on your plant is yours for the asking. Write today.

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*Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.*

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—The Scientific System of Water Treatment for all Industry

*How to plan a*

# COOLING WATER SUPPLY FOR A REFRIGERATING PLANT

**Another in the series of basic Piping Layouts prepared by Jenkins Bros.**

**Cooling Water** is required for the individual compressor jackets and refrigerant condenser in any refrigerating plant or air conditioning installation using compressors of greater than 15 tons capacity. The water flowing through the condenser removes the heat extracted from the material being cooled, while the water in the compressor jackets maintains the operating temperature best suited to efficiency and long service.

**The Proper Volume of Water** necessary for each of the operating units is assured by thermostatic control valves set to maintain predetermined discharge water temperatures. Valve bypasses permit manual control of the water and uninterrupted operation of the plant, should the automatic valves have to be removed for maintenance or repair. For ease of maintenance, drains are provided at all low points and shut off valves for each operating unit.

**An Automatic Drain Valve** with manual bypass releases water, should the temperature rise too high, instead of allowing it to return to the water cooler. An adequate supply of fresh city water for the equipment at all times is assured automatically through a pressure reducing valve, and manually through a bypass.

**All Gate Valves** recommended are the rising spindle type which show the amount of opening at a glance. The bypass globe valves used in conjunction with the automatic control valves are the iron body bronze mounted type with rising spindle and renewable composition disc. Bronze globe valves with renewable discs are recommended for the drain valve service because operation is frequent and closure must be tight.

## Jenkins PRACTICAL PIPING LAYOUTS

**Illustrating the proved 3-point formula for trouble-free, time-defying hookups**

1. **Place valves correctly in the line.**
2. **Use the right type valve for the service.**
3. **Choose Jenkins Valves for lifetime economy.**

8

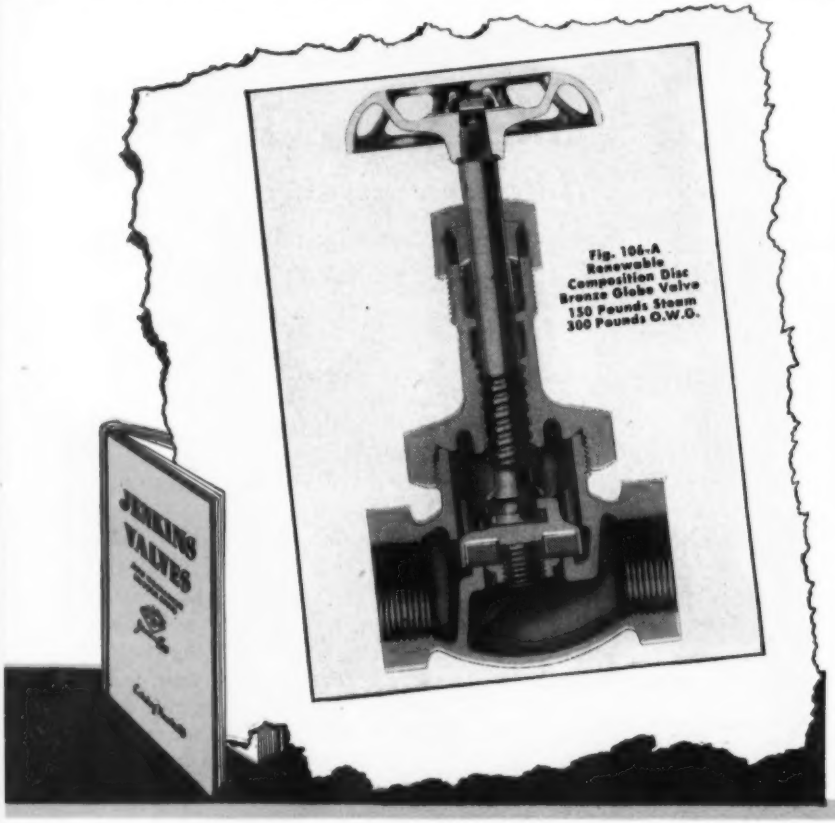



Fig. 106-A Renewable Composition Disc Bronze Globe Valve 150 Pounds Steam 300 Pounds O.W.G.

**Many Types and Pressure Ranges** of Jenkins Valves other than those shown can be used for this type of layout, according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements or when planning any major piping installation.

**Copies of Layout No. 8** will be furnished on request by Jenkins Engineers . . . also copies of future Piping Layouts. Just fill out and send the coupon.

**Fig. 106A, a Renewable Disc Bronze Globe Valve,** is designed with a convient slip-on stay-on disc holder that permits a quick change of disc. The resilient composition disc assures drop tight closure with the least closing effort. The sturdy screwover bonnet is unaffected by repeated disassembly and reassembly. Many other unusual features, described in the Jenkins Catalog, make Fig. 106A one of the most widely used of all Jenkins Valves.

### A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get the advantage of Jenkins specialized valve-engineering experience, – select all the valves you need from the Jenkins line, fully described in the latest Jenkins catalog, No. 76. It's your best assurance of the *lowest cost in the long run.*

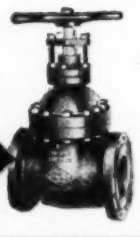
Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London, England.

# JENKINS VALVES

**LOOK FOR THE DIAMOND MARK**

*SINCE 1864*

TRADE JENKINS MARK



**125 TO 600 LBS. PRESSURE**

Jenkins Bros

# COOLING WATER SUPPLY FOR REFRIGERATING PLANT

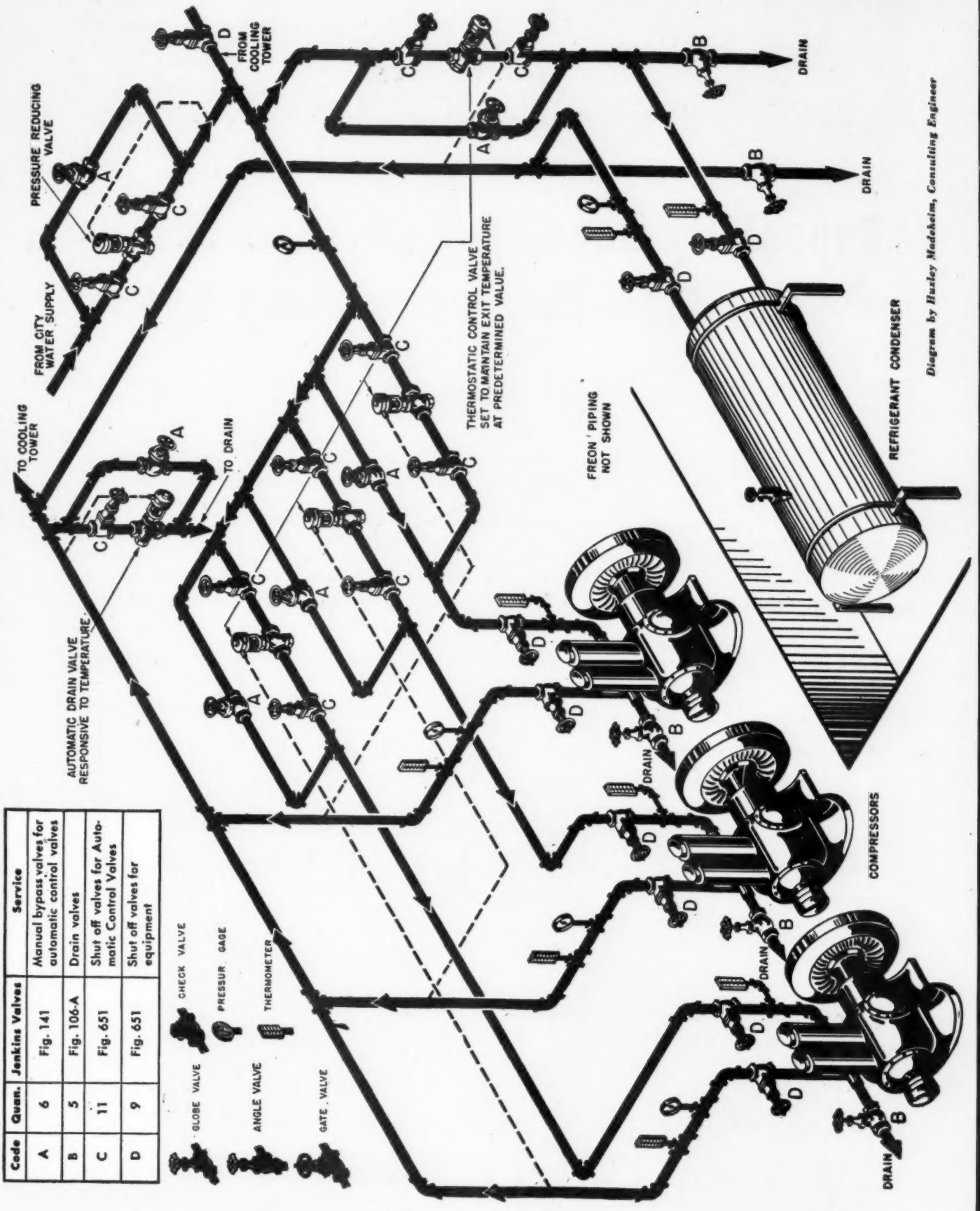



*Diagram by Huxley Madeheim, Consulting Engineer*

**VALVE RECOMMENDATIONS**

*For details — and valves to suit varying conditions — see Jenkins Catalog.*

| Code | Quan. | Jenkins Valves | Service |
|---|---|---|---|
| A | 6 | Fig. 141 | Manual bypass valves for automatic control valves |
| B | 5 | Fig. 106-A | Drain valves |
| C | 11 | Fig. 651 | Shut off valves for Automatic Control Valves |
| D | 9 | Fig. 651 | Shut off valves for equipment |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FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE
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POWER'S DATA SHEETS

Number 163

# Especially Developed for Gas Turbines, Air-Flow Chart Has Many Uses

▶ THIS CHART facilitates finding rate of air flow from pitot-tube traverse data for such installations as boiler duct work, air-conditioning systems, gas turbines and compressor discharges. Where air flow is obtained from a flowmeter the average velocity head can be found from the chart instead of by the time-consuming pitot-tube traverse. This diagram may be used for any gas or mixture of gases having the same molecular weight as air, a value of about 29.0.

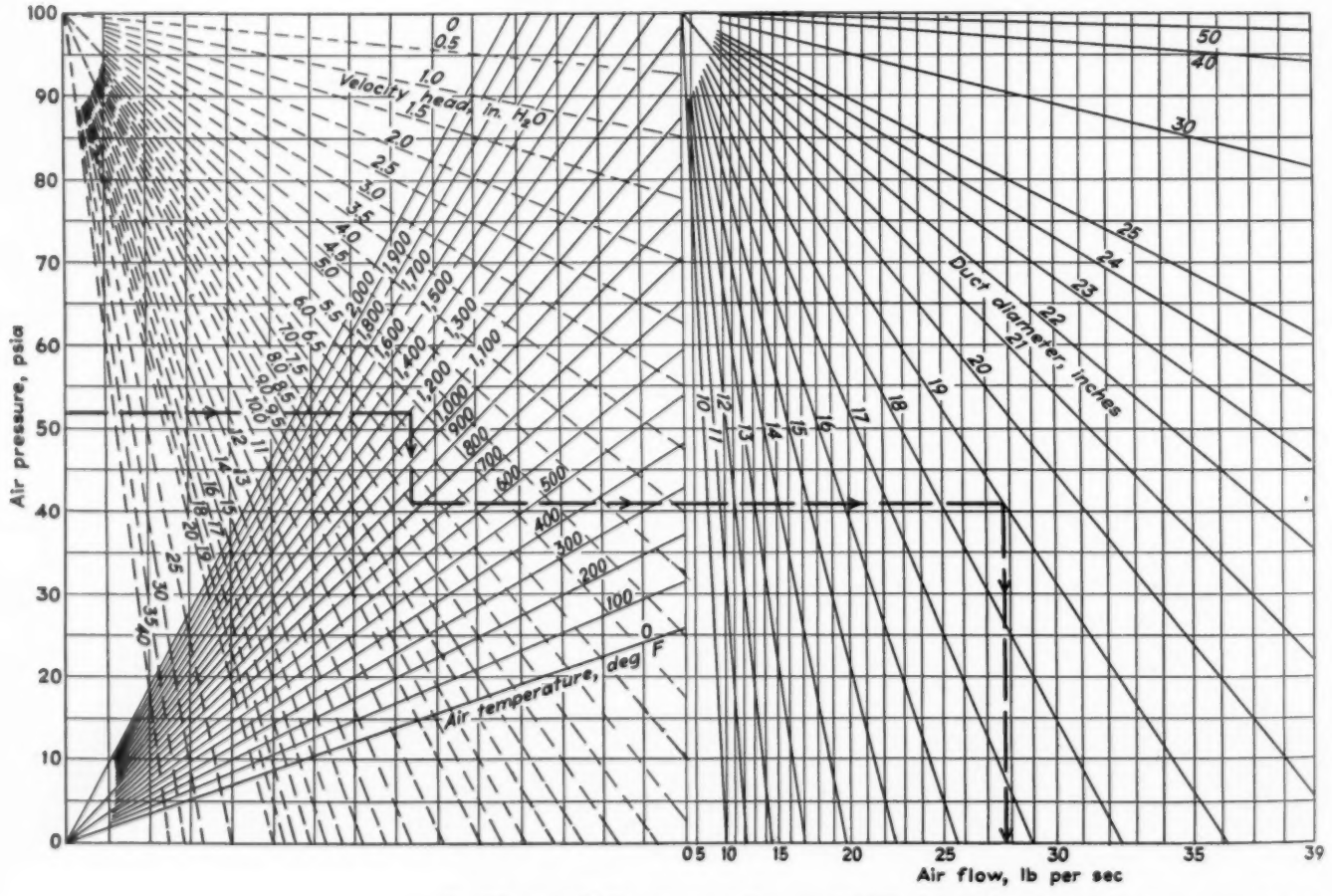
Based on the universal gas equation, this graph is a plot of the formula:

$$h_w = 37.2 \times \frac{w^2 (t + 460)}{PD^4}$$

where $h_w$ is the gas velocity head, in. $H_2O$; $t$ = gas temperature, deg F; $w$ = air- or gas-flow rate, lb per sec; $P$ = gas pressure, psia; $D$ = duct diameter, in.

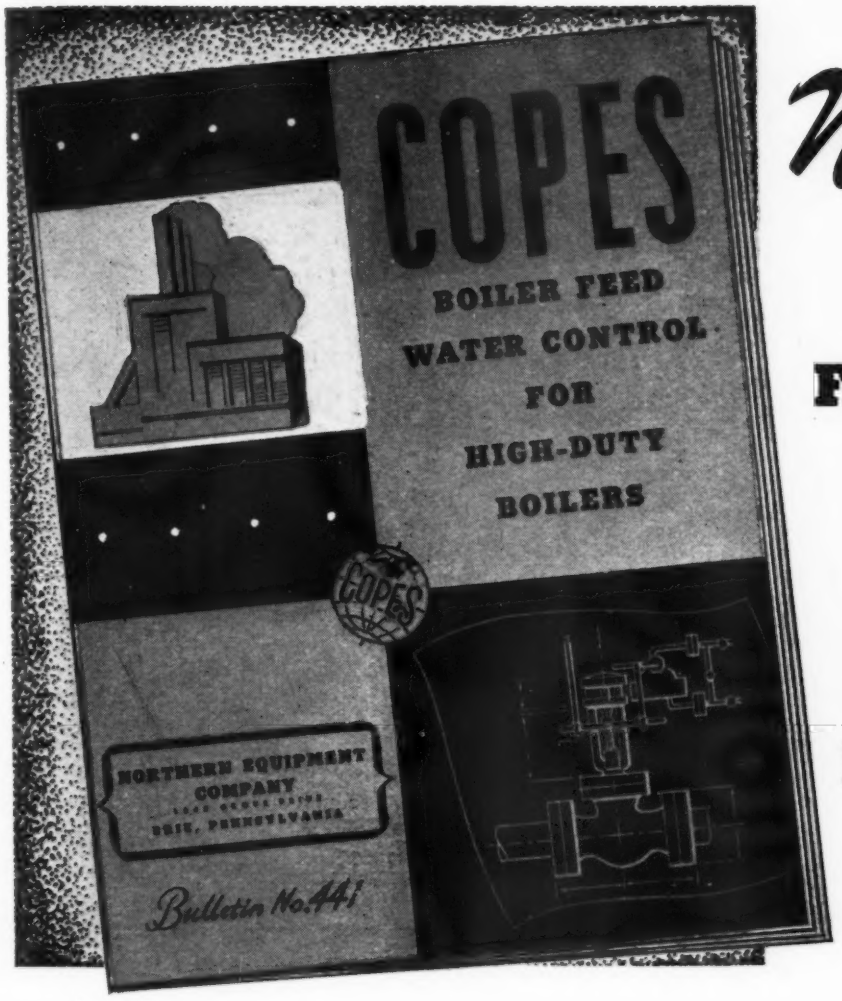
*Example:* With air pressure = 52 psia, air temperature = 1200 F, velocity head = 7.0 in. $H_2O$, duct diameter = 19 inches, follow trace on chart and find air flow = 27.8 lb per sec.

*Example:* Given air pressure = 60 psia, air temperature = 1000 F, duct diameter = 22 in., air flow = 36 lb per sec, solve for average velocity head. Find vertical ordinate at intersection of 60 psia and 1000 F, then find horizontal ordinate at intersection of 22 in. and 36 lb per sec; for answer locate intersection of vertical and horizontal ordinates at value of 5.0 in. $H_2O$, velocity head.




By WARREN M ROHSENOW, ENSIGN, USNR, *U. S. Naval Engrg Experiment Station*

© POWER




# *New Book*

## ON FEED WATER CONTROL for HIGH DUTY BOILERS

***Write for a copy*** of Bulletin 441 if you have — or plan to install—boilers operating at high pressures, with large capacities, or with heavy load swings. Learn how the COPES Flowmatic—now adaptable to any space limitation or operating preference—provides effective, economical feed control for modern steam generators. Study the schematic hook-ups. Check the charts showing results in five representative plants. Write *now!*

**NORTHERN EQUIPMENT COMPANY, 361 GROVE DRIVE, ERIE 6, PENNSYLVANIA**

*Feed Water Regulators, Pump Governors, Differential Valves,*
*Liquid Level Controls, Reducing Valves and Desuperheaters*

**BRANCH PLANTS: Canada, England, France. *Representatives Everywhere***

★ **GET CLOSER LEVEL CONTROL WITH THE** COPES FLOWMATIC ★ REGULATOR — FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

# Plumber or Prince?

There's an old fairy tale about the unhappy king whose physicians told him that to be happy he'd have to find, and wear, the shirt of a happy man. When his messengers, after months of searching, finally found a happy man, he was a beggar—without a shirt.

I'm reminded of this story by our national obsession to get, then spend, money. Success is judged, not by accomplishment, but by bankroll. Our literature interprets the old saying "lived happily ever after" as making one or several millions. Actually, the reverse is true; the happy men are those without the responsibilities —and the ulcers—that wealth brings.

During the war, we spread our itch for income all over the world, so soldiers of other nations resented our soldier pay, so industry as usual made expanded profits, so workers became dissatisfied with their incomes. Now the veteran returns to a homeland where the primary aim seems to be to get while the getting is good regardless of the effect on others.

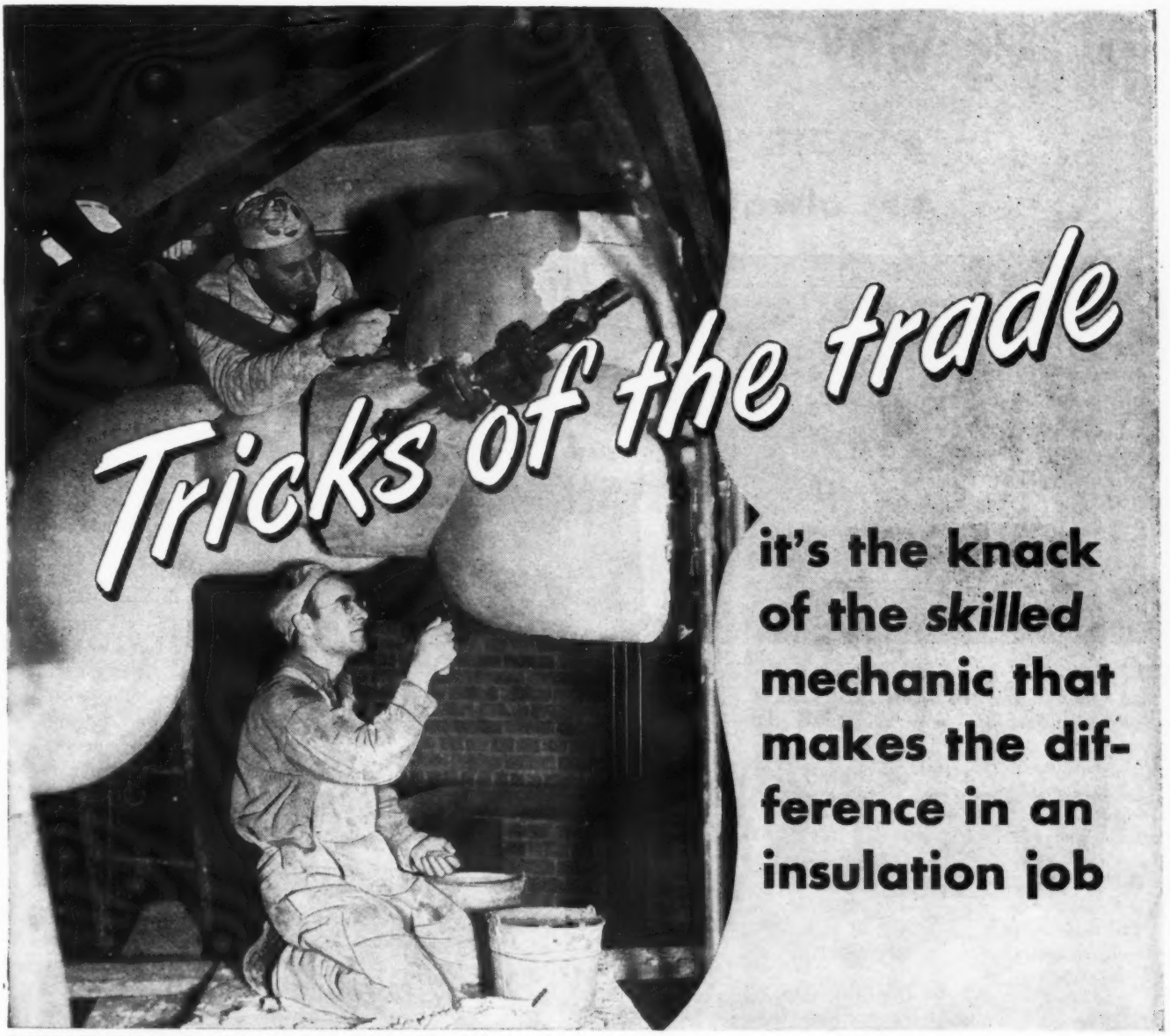
War dislocations, housing shortages and chaotic labor conditions have destroyed much of our home life. The service man, expecting to return to sanity, finds insanity instead. While we worried about psychological readjustment of the returning GI, we should have worried about keeping ourselves in adjustment.

The result is just what can be expected. Veterans are rejecting their old jobs in sound industry with low labor turnover and steady growth for highly speculative, quick-money jobs. In one case, the first ten veterans turned down their former jobs—at doubled pay—for higher-income but highly temporary jobs. They gave up seniority and security to take a chance.

The fault is not theirs, but ours. We're following a mad urge to get two dollars where one was enough before—and pushing each dollar down to a quarter of its former value. Temporarily, at least, the stable jobs—which include those in power plants—are going begging. I am reminded of a conversation I had some years ago with the American representative of a European power-equipment manufacturer. He was paid more than the president of his company—to meet expected American standards! When I expressed surprise, he explained that in his country wealth or income wasn't the standard of success. There, a college professor or a plumber was the social equal of a prince or a president if he was as smart. Dollars didn't matter.

So let's, for ourselves, look sanely at the situation. Let's consider such elements as permanence of employment, growth of the industry, personal opportunity for steady advancement, and general desirability of working conditions in their true relationship to temporary extra income.

George Edwards
*Engineer*




MEN WHO KNOW HOW help another steam plant keep fuel costs down . . . this time using two types of J-M insulations.

THERE is an art in properly applying insulations—and only specialists know the many little practices that make for success. Lack of this knowledge may greatly reduce the value of your insulation investment.

For permanent heat control and fuel savings, Johns-Manville places at your disposal a trained force of expert workmen and engineers—a nationwide organization capable of handling all details of an insulation job and taking complete responsibility from planning through application.

In some areas, J-M's own construction forces are ready to help you. In others, J-M Technical Service Units have been created by selecting contracting companies of proved reliability and specialized experience in this field.

These Insulation Specialists, backed by years of insulation research and practical experience, are able to choose the right insulating material for you from a complete line of insulations. They specify the right thickness, the right bond or joint . . . for every industrial temperature, every service requirement.

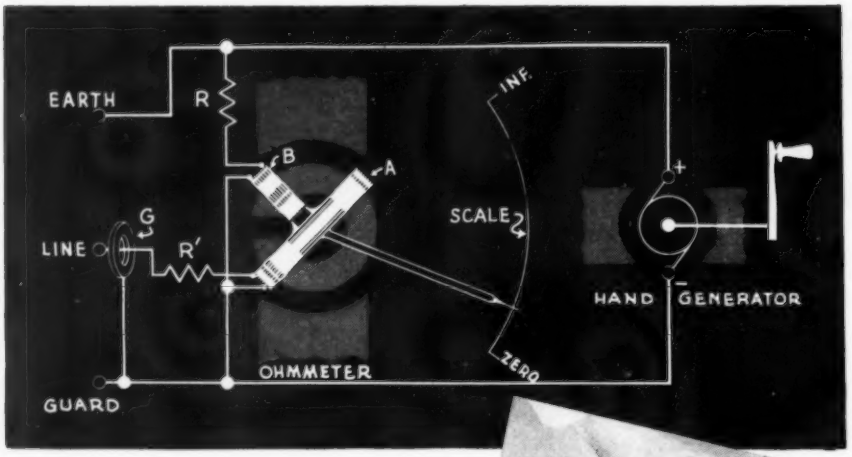
All are important reasons why J-M may be able to solve your next insulating problem . . . more quickly, *safely!* For further information, write Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JOHNS-MANVILLE PRODUCTS

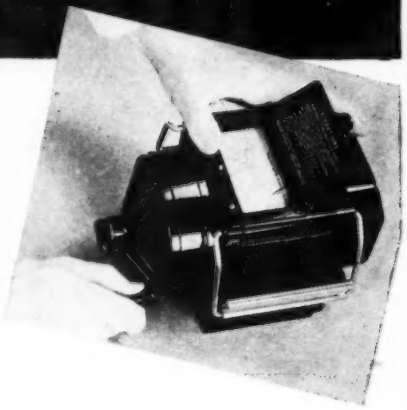
**JOHNS-MANVILLE *First in* INSULATIONS**

# Here's why—

## "MEGGER"* Insulation Testers are always dependable—




*In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.*



The "Megger" instrument is simplicity itself. The circuit diagram shows *all* elements—hand-cranked generator, fixed resistance coils and ohmmeter with pointer and scale. Nothing more is needed and nothing could be simpler. In making resistance tests, you merely connect leads from the instrument to the apparatus or circuit under test, turn the crank for a few seconds, and read the insulation resistance directly on the scale.

Power generation and distribution practice has dictated certain standards of quality and performance that every piece of electrical equipment is expected to meet. "Megger" insulation testing instruments have been and will continue to be built in conformity with these high standards.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-P.

**Trade Mark U. S. Pat. Off.*

**JAMES G. BIDDLE CO.** • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**


## Reader's Problems

(*Continued from page* 113)

of steam jet conveyors is lower but the additional operating cost soon offsets the initial saving.

I suggest that *JHL* investigate either a chain or belt bucket conveyor and compare their first cost and operating rate against the steam jet type before making the installation.

*New York, N. Y.* JACK MORRIS

### Mechanical Conveyor Is Cheaper to Operate

UNLESS JHL HAS LIMITED SPACE for operation, which makes a special design necessary a mechanical coal-handling system is cheaper to operate than a pneumatic or steam unit.

Steam costs for operation of a jet unit average about 15¢ per ton. Operating costs for a bucket elevator should not exceed 0.5¢ per ton. Therefore if 10 tons of coal per day are handled the extra cost of power alone amounts to about $450 per year more for the jet system than the bucket elevator.

First costs of the steam-injector installation will vary with design. If dry coal is transported a cyclone separator with trap, electric timer and steam valve, condenser and dust washer must be included. Other factors involved in handling 2-in. coal pneumatically are control of feeding system, wear on pipe and fittings, noise and dust nuisance.

*Saint John, N. B.* C G CLARK

### The Steam Conveyor Uses Too Much Steam

I SUGGEST that *JHL* make a thorough study of the steam-jet conveyor before deciding to use it. He should plan on receiving wet and icy coal at times and these are hard to pass through a jet conveyor.

I think a good bucket conveyor would answer his purpose much better. A steam-jet conveyor usually requires large amounts of steam, and this is an important factor in the efficient operation of a boiler room.

*Newark, N. J.* R C CONK

### Bucket Conveyor Is More Satisfactory

IN ANSWER TO *JHL*'s problem the jet or vacuum conveyors have the following operating characteristics: (1) Jet conveyor consists of a pipeline made to withstand the action of material being conveyed.

**Note the Modern Design...**

Pat. No. 1,866,292

***of this small gate valve***

# CHAPMAN LIST 960

Bonnet fitted with substantial forged steel yoke; flanged forged steel packing gland eliminates exposed threading on valve yoke (preventing rust and corrosion when used in exposed locations); swivel bolts for holding packing gland; no gaskets to blow (as in valves with flanged bonnet connections).

Chapman List 960 valves are made in sizes from ¼" to 2" — in carbon steel for pressures to 800 pounds; in alloy steel for pressures to 1000 pounds at 750°F. (For higher pressures, specify List 990). Seats and plugs can be super-hardened for extra severe services.

## *The Chapman Valve Manufacturing Company*

**INDIAN ORCHARD, MASSACHUSETTS**

# When Time Means Money
# AIR EXPRESS EARNS ITS WEIGHT IN GOLD

**22% slash in rates since 1943 makes this fastest delivery service a better business buy than ever**

Do you need something fast — to keep your business going and men at work, to serve a customer or to *get* one? Do you need "delivery speed" on new merchandise or sales pieces to keep a customer happy? Then use Air Express. Let its speed save time (a matter of hours from coast-to-coast). And the time you save means money — money that makes this fastest delivery service "earn its weight in gold!"

HERE'S HOW LITTLE IT COSTS (U. S. A.)

| AIR MILES | 2 lbs. | 5 lbs. | 25 lbs. | 40 lbs. | Over 40 lbs. Cents per lb. |
|---|---|---|---|---|---|
| 149 | $1.00 | $1.00 | $1.00 | $1.23 | 3.07 |
| 349 | 1.02 | 1.18 | 2.30 | 3.68 | 9.21 |
| 549 | 1.07 | 1.42 | 3.84 | 6.14 | 15.35 |
| 1049 | 1.17 | 1.98 | 7.68 | 12.28 | 30.70 |
| 2349 | 1.45 | 3.53 | 17.65 | 28.24 | 70.61 |
| Over 2350 | 1.47 | 3.68 | 18.42 | 29.47 | 73.68 |

## Specify Air Express — Better Business Buy Than Ever

Shipments go everywhere at the speed of flight between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Fastest air-rail service to and from 23,000 off-airline points in the U. S. Service direct by air to and from scores of foreign countries in the world's best planes — manned by the world's best crews — giving the world's best service.

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GETS THERE FIRST

**Write Today** for new Time and Rate Schedule on Air Express. It contains illuminating facts to help you solve many a shipping problem. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Railway Express office.

**Phone AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY**
**Representing the AIRLINES of the United States**


It can be made to run at any angle or elevation. This makes it adaptable to any type of building construction. (2) Steam-vacuum conveyor must be made with an airtight chamber and discharge mounted on top of storage bin.

Instead of these types I recommend either the centrifugal discharge or the continuous-bucket conveyor. The centrifugal-discharge conveyor is the cheapest in first cost, but runs higher in maintenance. It is not suitable for buildings where noise is objectionable. The bucket types are higher in first cost, but are less noisy. Elevators have buckets mounted on chains. The coal is elevated from track hopper into a storage tank and later discharged into live storage.

A continuous-flow elevator conveyor suited for *JHL*'s purpose can handle coal up to 2½ in. very easily. It also conveys a solid column of material at speeds from 20 to 150 fpm. Coal is handled gently so that no coal dust is created. Any dust found in feeding and discharge is confined to dust-tight casing and spouts, which prevent fire hazard.

*Oaklyn, N. J.* C. A. WILKES

## Inhibitors in Turbine Oil

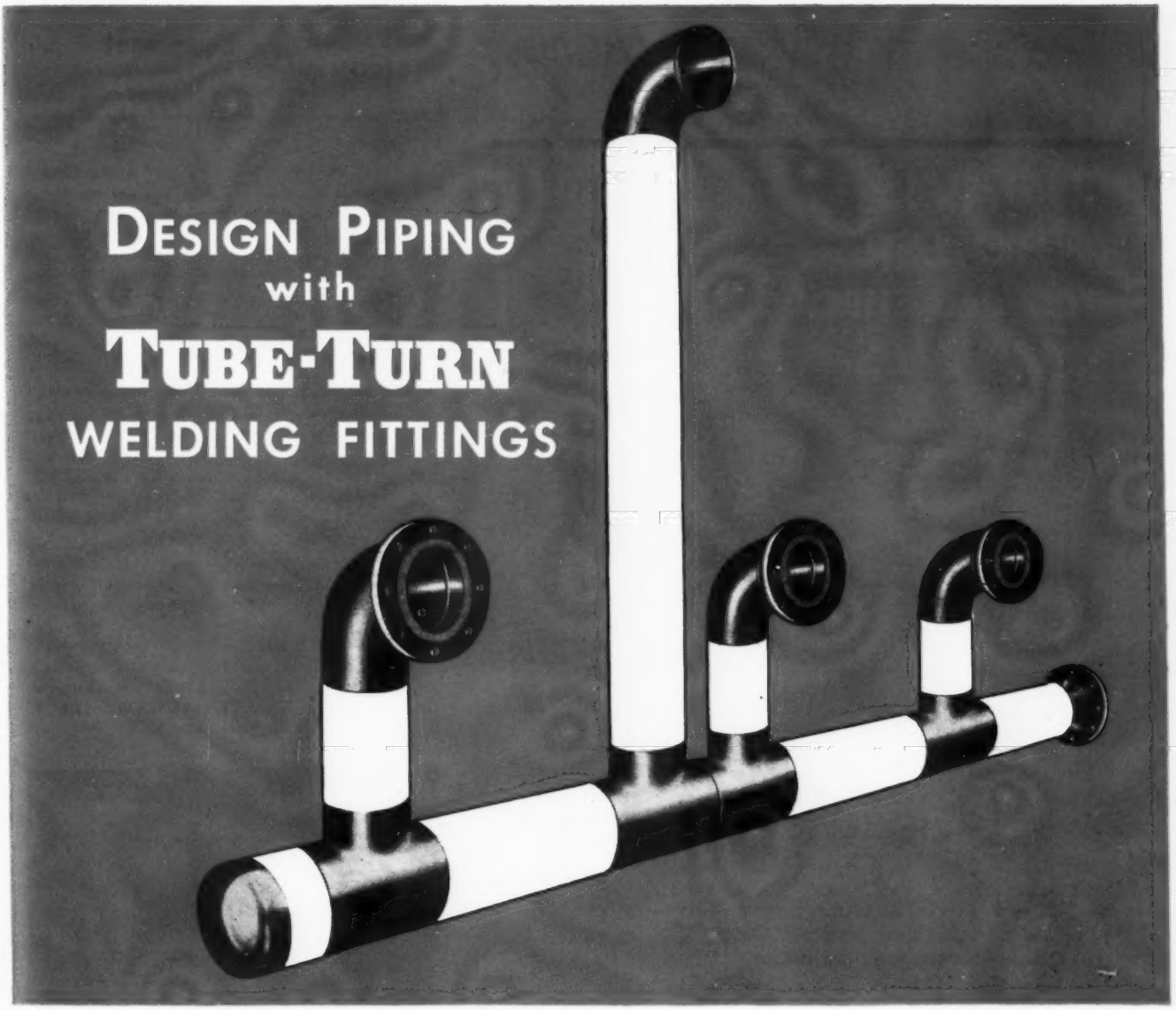
(*Continued from page* 89)

ive. Again, the rust deposit was heavy. The third strip at *C* came from the test on an oil containing an oxidation inhibitor and a rust preventive but the latter was not capable of preventing rust for the full 48 hr. The last strip at *D* was obtained from an oil containing both an oxidation inhibitor and a preventive that stopped rusting for the full term of the test.

Because operating conditions in a turbine are not particularly severe with respect to rusting, a mild type of preventive is satisfactory. It has been observed that turbine oils develop inhibitors of their own during operation. When new turbines are started, old oil should be used or a small percentage added to the new oil because of the presence of these rust-preventive materials. Some operators question the need for a rust inhibitor because it prevents rusting only when the oil comes in contact with the steel.

Turbine oils containing inhibitors of oxidation have been in use for a number of years and are giving excellent service. The newer turbine oils inhibited against both oxidation and rust have been in service for only part of their expected life. Service data, however, indicate that these new oils are living up to expectations.

# DESIGN PIPING with TUBE-TURN WELDING FITTINGS



PIPING arrangements such as this special header call for the design of Tube-Turn welding fittings. Long radius and short radius . . . light weight to extra heavy . . . 45°, 90°, 180° or odd angles when necessary . . . all help to simplify modern piping design.

Close inspection insures that all Tube-Turn fittings of the same part number are identical in all dimensions. Tube-Turn welding fittings are available in sizes ranging from one-half inch to 30 inches. Uniform wall thickness, smooth inner wall and fine grain structure are plus features of the Tube Turns line.

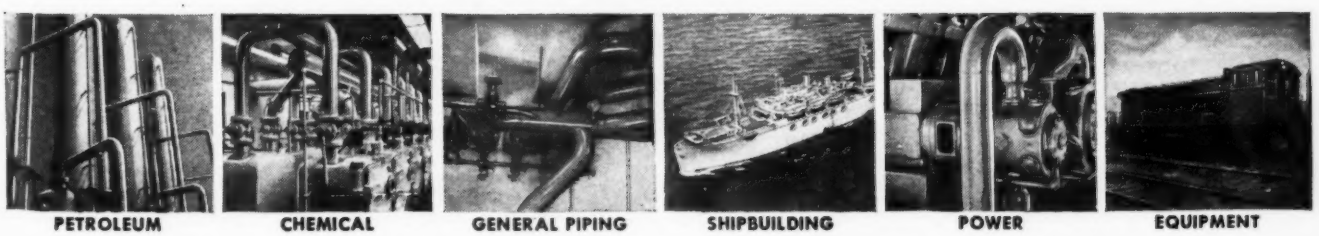
Consult your favorite piping authority and see your Tube Turns distributor. For more information on the superiority of Tube Turns' exclusive manufacturing methods and data on successful installations in many industries, write for Catalog 111.

• • •

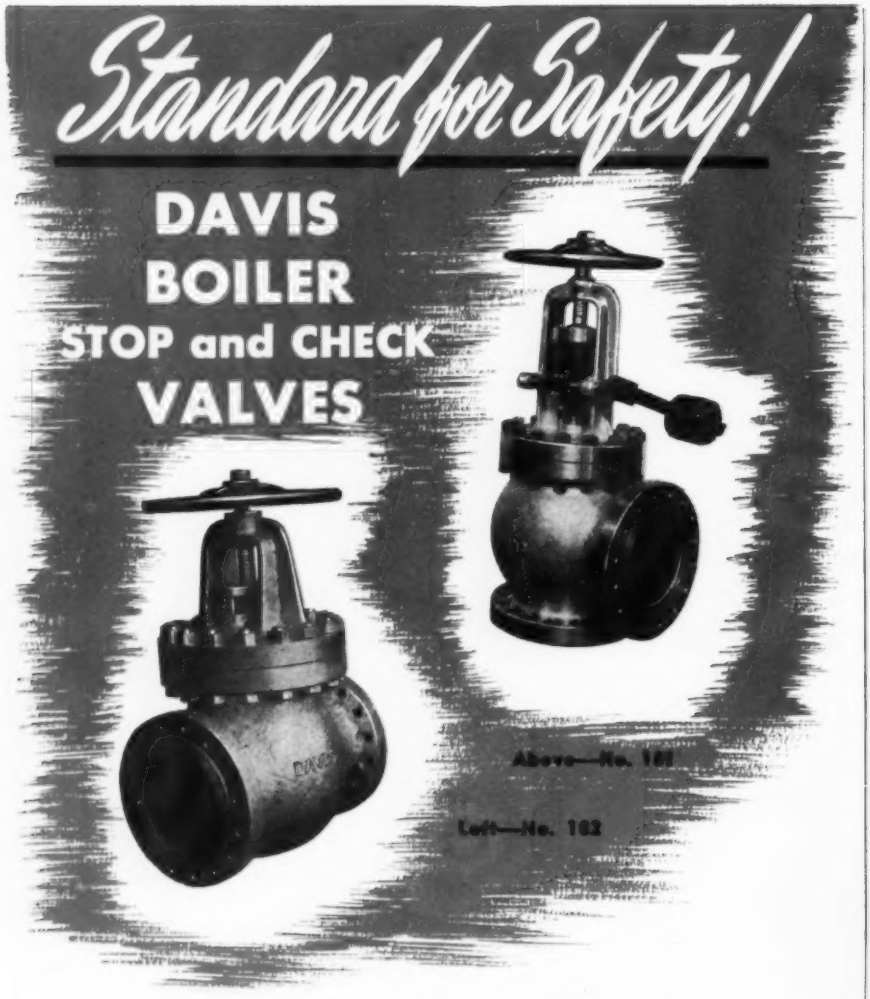
**Selected Tube Turns Distributors in every principal city are ready to serve you from their complete stocks.**

**TUBE TURNS** (Inc.), Louisville 1, Kentucky. Branch Offices: New York, Washington, D. C., Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago, Houston, San Francisco, Seattle, Los Angeles.

**TUBE-TURN** TRADE MARK *Welding Fittings and Flanges*



PETROLEUM | CHEMICAL | GENERAL PIPING | SHIPBUILDING | POWER | EQUIPMENT




● Davis Stop-and-Check Valves have long been "Standard for Safety" in boiler plants throughout the nation.

NO. 101 — Designed particularly for finest high pressure, heavy duty steam plants. Features an external oil dash pot and counter-weighted lever which can be moved by hand at any time to test the valve and also provides visible action. Inside, it is as clean and simple as a streamlined globe valve.

NO. 102 — The popular valve for general service. Features an ingenious valve design with internal steam dash pot eliminating any tendency to chatter.

BOTH TYPES are available in a complete range of sizes. Globe, angle, corner or elbow body patterns. Semi-steel, carbon steel, or alloy steel bodies, with suitable trim for any pressure and temperature. For prompt service, send an outline of your requirements to the

DAVIS REGULATOR CO.,
2540 S. Washtenaw Ave., Chicago, Ill.

DAVIS REGULATOR COMPANY


## New Equipment

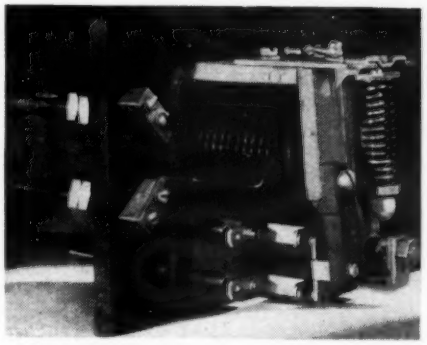
(*Continued from page* 128)

rate without a fan. Battery charger operates from usual 110-v ac power supply to deliver required rating of dc to battery. Rectifier makes possible design of fast battery chargers rated 50 amp without any moving parts. **Benwood-Linze Co, St. Louis, Mo.**

### Heat Measurement

CALCULATING DEVICE, known as *Heat-O-meter*, measures radiation for steam and hot-water heating systems. Device consists of a round dial with three concentric celluloid printed disks. Its operation does not involve subtraction, division, complicated multiplication or use of a formula. Just turn dial and receive correct answer.

Dial also contains sizes of mains, returns, risers, radiator sizes and capacities, round- and sectional-boiler net ratings, chimney-flue sizes and capacities with minimum and maximum heights, hot-water tank sizes and capacities, fuel-oil tank sizes and capacities, hot-water generator capacities and other heating information. **Heat-O-Meter, 424 W 42nd St, New York 18, N. Y.**



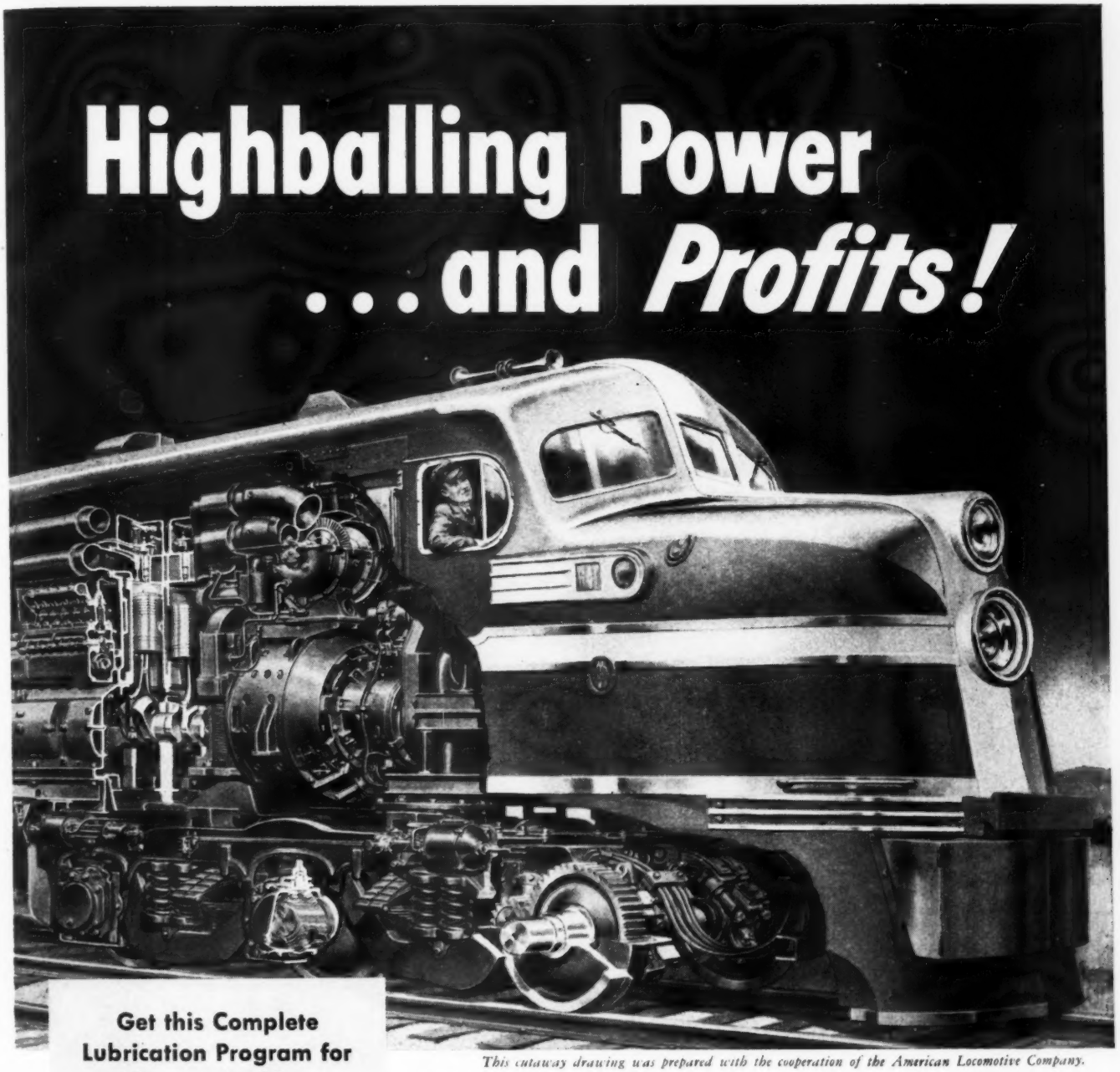
### Magnetic Overload Relays

AYJ RELAYS, for dc operation, provide magnetic overload protection on general-purpose and mill-motor applications and prevent damage to hoist, windlass and capstan equipment when load or cable jams on marine control. Single-break normally closed main contacts and double-break auxiliary contacts are suitable for carrying 5 amp continuously and for interrupting a dc inductive coil load of 150-v-amp maximum. Coils and coil studs are available for currents ranging from about 75 to 625 amp. Coils and auxiliary contact parts are insulated from the relay frames for 600 v. **Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.**

### Electronic Air Filters

ELECTRO-AIRMAT, an electronic air filter, has a collector element made of paper and trade-named *Airmat*. This material is built up of a number of porous tissuelike plies of short cellulose fibers in jackstraw arrangement. When an electrostatic charge is applied to the element the plies tend to separate and

# Highballing Power ... and *Profits!*



*This cutaway drawing was prepared with the cooperation of the American Locomotive Company.*

**Get this Complete Lubrication Program for all your machines**

- **Lubrication Study of Your Entire Plant**
- **Recommendations to Improve Lubrication**
- **Lubrication Schedules and Controls**
- **Skilled Engineering Counsel**
- **Progress Reports of Benefits Obtained**

GARGOYLE Lubricants

POURING on the power—at high speeds — this big Diesel electric locomotive combines many lubrication problems similar to those in your plant.

Here, inside this power-plant-on-wheels, as in a stationary power plant, Socony-Vacuum's correct lubricants for every machine give more continuous operation at lower costs.

In this Diesel, for instance, gas temperatures soar to above 3000° F., pressures to above 600 lb. per sq. in. Gargoyle D.T.E. Oils stand up under this heat and pressure, reduce wear and blow-by to a minimum. The same stable lubricants protect vital parts of the generator and turbo-supercharger.

Those driving motor pinions and gears operate under temperature variations of from minus 50° F., to 140° F., with dust and water often present. Gargoyle Compounds stick on the job, and protect against wear. On the many grease-lubricated parts Gargoyle greases stand up for long periods of time and provide Correct Lubrication.

Why not get all these benefits now ... for your plant?

## Socony-Vacuum Oil Co., Inc.

**and Affiliates: Magnolia Petroleum Co. · General Petroleum Corp. of Calif.**

**TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.S.T.—NBC**

# LIQUID OR GAS TEMPERATURE CONTROL PROBLEM?

These publications describe the NIAGARA AERO HEAT EXCHANGER and some of its applications. It accurately regulates the temperature of gases and liquids. Industrial plants using chemical and heat-treating processes have gained extra benefits from using this equipment wherever cooling water is used or any fluid is cooled to exact temperatures.

Some of the applications are: controlling temperature of liquid chemicals and intermediates in process; controlling jacket water temperature in power and process equipment; regulating the temperature of controlled atmosphere; controlling liquid bath temperatures.

As a cooler, the NIAGARA AERO HEAT EXCHANGER saves the cost of 95% of the water circulated.

*Niagara Bulletins 90, 94 and 96 give detailed information. Write for them today.*

**NIAGARA BLOWER COMPANY**

*Over 30 Years of Service in Industrial Air Engineering*

DEPT. P-36. 6 E. 45th St. NEW YORK, 17, N. Y.

*Field Engineering Offices in Principal Cities*

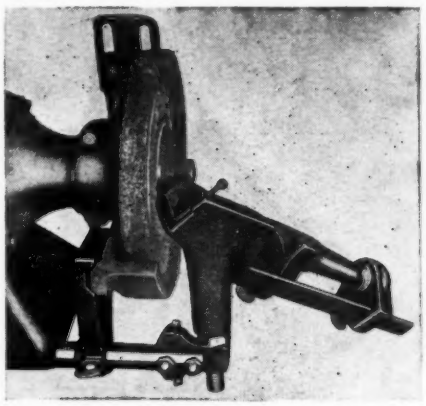
INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

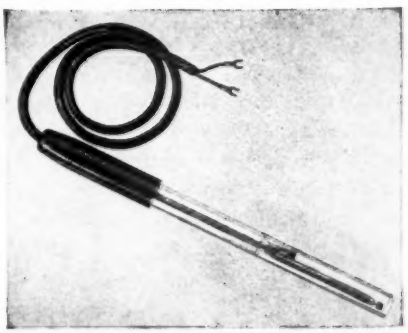

each fiber becomes an electrode that attracts and holds dust and smoke particles. When paper has accumulated its dust load it is replaced with clean paper by turning the crank of a mechanical device, which folds material in conformity with serrated base section of filter.

Spare cells with fresh *Airmat* can be provided for convenience in servicing. Where only a few units are required, a manual loader suffices. It is claimed that tests by the discoloration method, using a standard 24x24-in. unit with a rating of 1000 cfm and with a normal flow through the collector element of 35 fpm, give *Electro-Airmat* an "arrestance" rating for atmospheric dust or smoke of 90% or better. **American Air Filter Co, 200 Central Ave, Louisville, Ky.**



## Drill-Grinding Fixtures

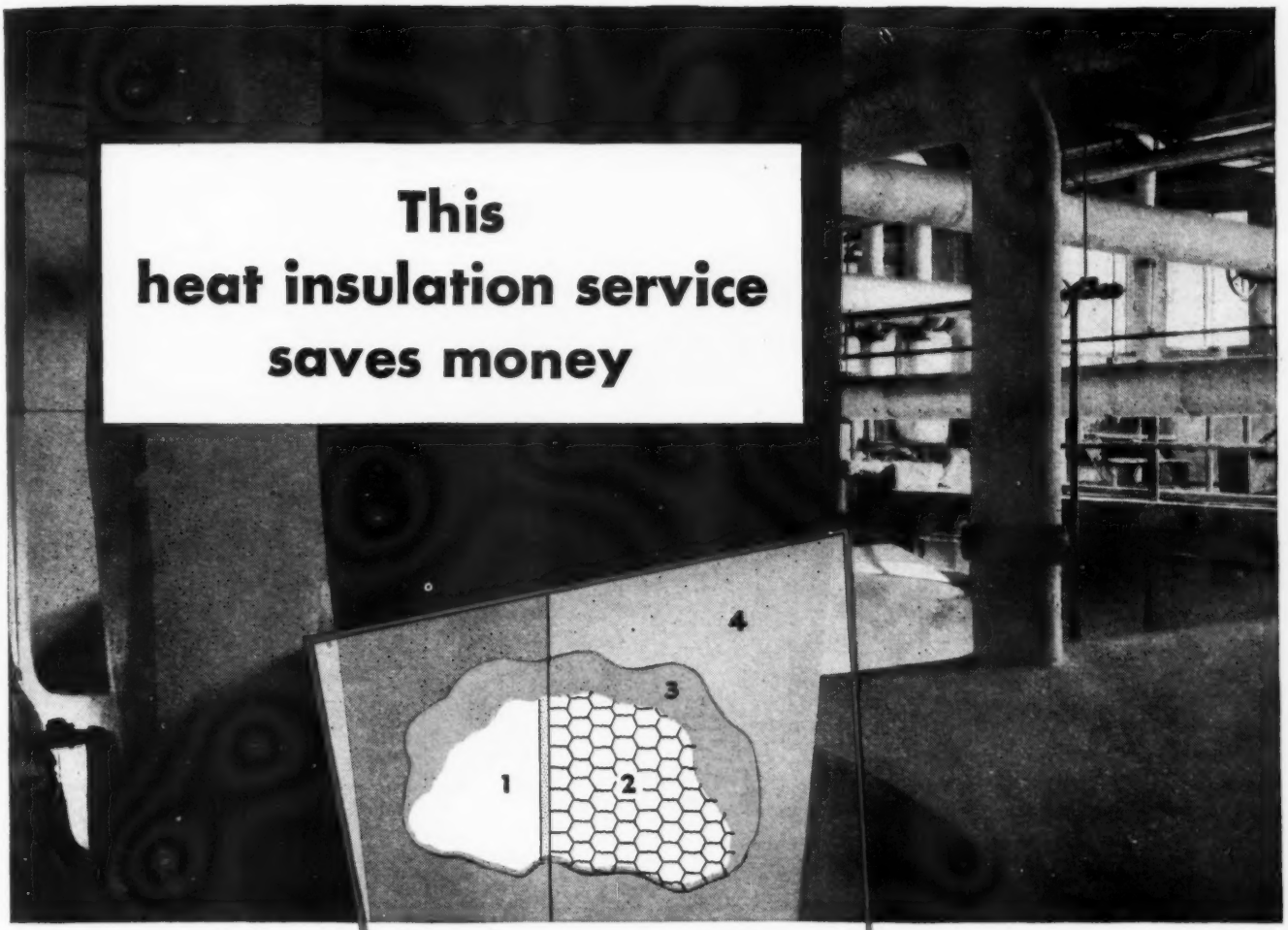
IMPROVED IND-L-WAY DRILL-GRINDING FIXTURES, available in two models, handle all sizes of drills from ¼ to 2⅞ in. in diameter and up to 26 in. long. They are for use with Black and Decker and Van Dorn bench and pedestal grinders or other makes of grinders having the same dimensions. **Industrial Manufacturing Co, 1900 Euclid Ave, Cleveland, O.**



## Conductivity Cell

TYPE CEL-F WAND CELL meets need for a conductivity cell that can be readily and safely immersed in a vat or tank and readily withdrawn after readings are taken. Cell takes form of a heavy-walled industrial Pyrex glass wand with a hard-rubber handle. Glass body measures about 1 in., outside dia. by 20 in. long. Electrodes are of platinized platinum. Plunge wand into liquid and read conductivity in any desired terms from a correspondingly calibrated solu-bridge or

# This heat insulation service saves money




A typical Armstrong heat insulation job in the Angier School, Waban, Mass. UPTAKES from heating boilers are insulated with (1) 1" 85% Magnesia block, secured with (2) wire netting. Surface is ½" asbestos cement, (3) applied in two coats, the final one (4) with hard finish. Steam and return piping, smoke flues, and boilers were also insulated.

Not only when you have heat insulation installed, but all through its life you will save money by having one responsible organization supply these essentials:

MATERIALS. Insulations of tested efficiency and economy—a complete line covering every temperature and condition—are used by Armstrong's Contract Service.

ENGINEERING. Armstrong's engineering staff is ready at all times to cooperate with you in writing practical specifications to keep heat losses to a minimum. In planning, estimating, and scheduling your job, these men draw on years of experience with heat insulation work.

WORKMANSHIP. Crews of trained Armstrong men apply your insulation in accordance with best standards and practices, for efficient service.

Also, when you centralize responsibility in Armstrong's Contract Service, your job proceeds smoothly, swiftly, economically. And you can count on Armstrong-installed insulation to keep down your fuel bills year after year.

Armstrong's Contract Service is located conveniently near you. Just phone any of the offices listed below. Armstrong Cork Company, Building Materials Division, 7003 Concord Street, Lancaster, Pennsylvania.

## ARMSTRONG'S INDUSTRIAL INSULATION

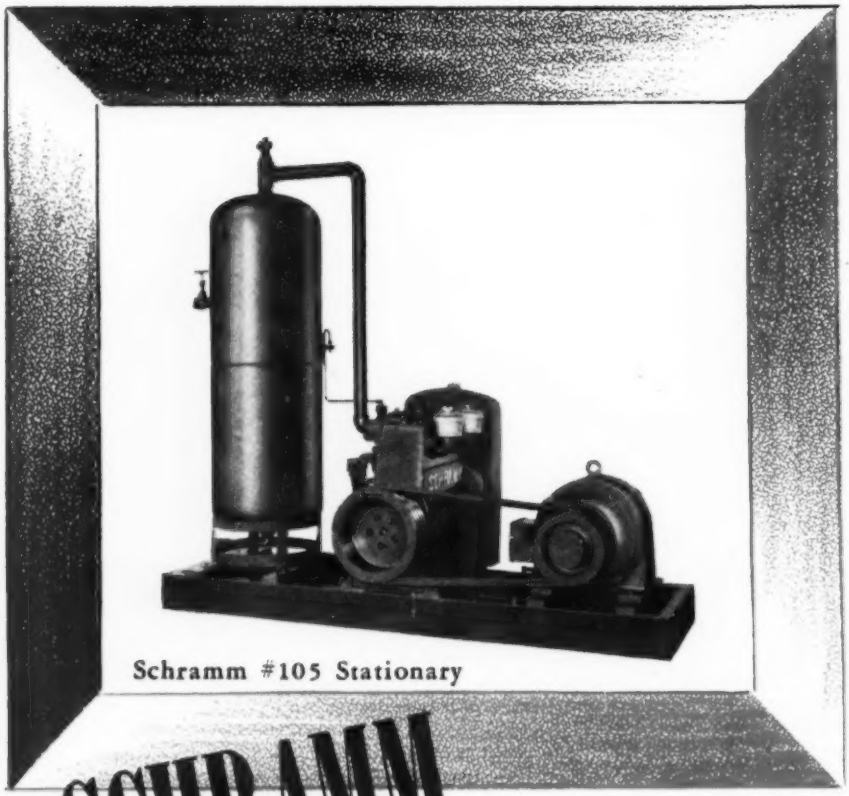
*Complete Contract Service For All Temperatures*

From 300° Below Zero — To 2600° Fahrenheit

ALBANY, N. Y. • ATLANTA, GA. • BALTIMORE, MD. • BIRMINGHAM, ALA. • BOSTON, MASS. • CINCINNATI, OHIO • CLEVELAND, OHIO
COLUMBUS, OHIO • DALLAS, TEXAS • DETROIT, MICH. • HARTFORD, CONN. • HOUSTON, TEXAS • INDIANAPOLIS, IND. • JACKSONVILLE, FLA.
KANSAS CITY, MO. • LOUISVILLE, KY. • MEMPHIS, TENN. • MILWAUKEE, WIS. • NEW ORLEANS, LA. • NEW YORK, N. Y. • PHILADELPHIA, PENNA.
PITTSBURGH, PENNA. • PROVIDENCE, R. I. • RICHMOND, VA. • ST. LOUIS, MO. • TULSA, OKLAHOMA • WASHINGTON, D. C.

IN AIR COMPRESSORS . . . THERE ARE

MASTERPIECES *too!*



Schramm #105 Stationary

SCHRAMM

The superior features of Schramm Air Compressors put them in the class of a "masterpiece"! The reasons for this "extra" value in Schramm Compressors are: (1) 100% watercooled; (2) Forced Feed Lubrication; (3) Mechanical intake valve; (4) Compact, lightweight!

All features that are designed for heavy duty, continuous service, with minimum attention! Schramm enables you to do your compressed air jobs quickly—easily—economically! Start your compressor planning by writing today for detailed data on Schramm Compressors. Study the details of construction and you will see why Schramms are masterpieces in Compressed Air.

SCHRAMM INC.

THE COMPRESSOR PEOPLE

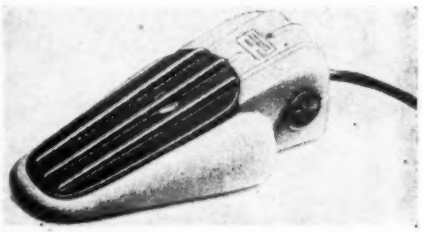
WEST CHESTER

PENNSYLVANIA

conductivity bridge. Although primarily intended as a dip cell, it can be conveniently clamped and left in place. **Industrial Instruments, Inc, 17 Pollock Ave, Jersey City 5, N. J.**

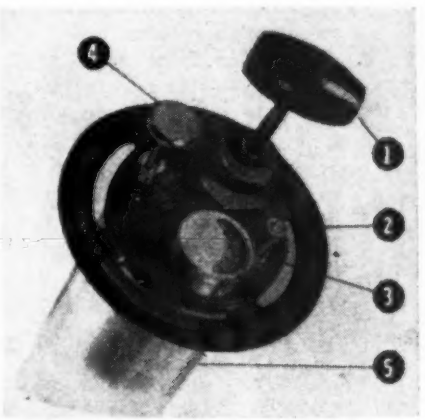
## Solvent Cleaner

OPTIMUS SOLVENT No. 2 removes grease, oil, carbon, grit and miscellaneous shop dirt from metal parts. Solvent will not harm metal surfaces or operator's hands. Completely miscible, this product combines in kerosene or other hydrocarbon diluent and removes soil from work by solvent cleaning action. Solvent available in 15- and 55-gal drums. **Optimus Detergents Co, 238 Church St, Matawan, N. J.**



## Foot Switch

TIME-O-LITE FOOT SWITCH controls spot welders, drill presses, sanders, lathes, jig saws, circular saws or any motor-driven equipment up to one hp. Neon pilot light on foot pedal, inside the switch, shows where pedal is in the dark. Switch is not bolted or screwed to floor as it has a non-skid base. It operates on any ac circuit. *Time-O-Lite* switch is heavy duty, snap action, single pole, double throw in effect. Two black outlets, each with 1500-watt capacity, operate electrical equipment when pedal is depressed. One red outlet turns electric equipment off when pedal is depressed. **Industrial Timer Corp, 117 Edison Pl, Newark 5, N. J.**




## Pressure Gun

DRAINMASTER PRESSURE GUN air blasts obstructions clear of piping, elbows, tees, long lines and all joints—from ½ in. dia up to 6 in. When plumbing is plugged, insert *Drainmaster* at opening nearest obstruction, pump gun up to proper air pressure and press release button. Released pressure travels through pipe and hits obstruction, clearing line quickly.

Working parts include: (1) Built-in pump

WORTH REMEMBERING

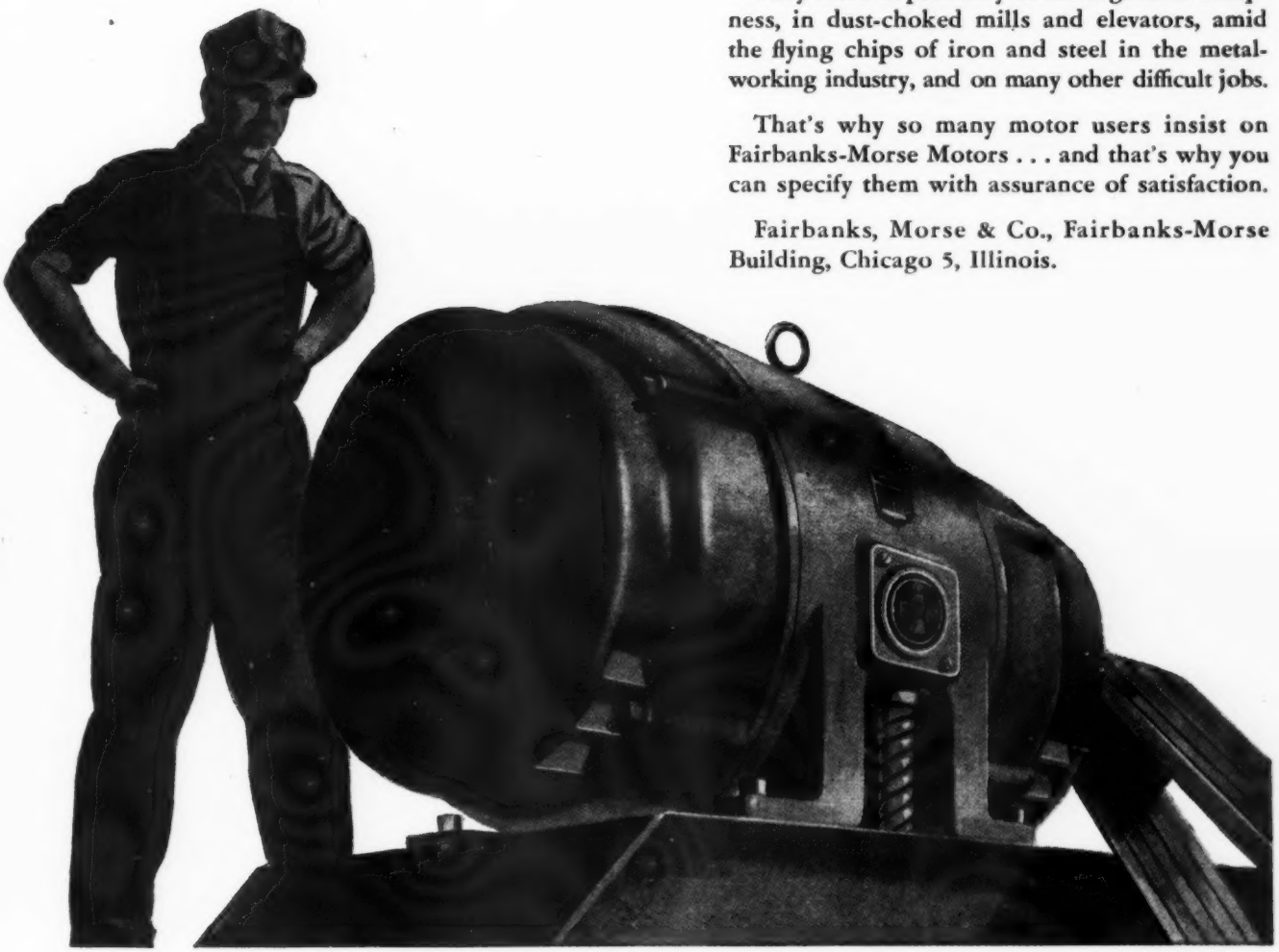
# see Fairbanks-Morse FIRST FOR MOTORS

CONSTANT research and development have contributed many features which make Fairbanks-Morse Motors outstanding. Today, they are an accepted standard in industry.

They serve dependably in underground dampness, in dust-choked mills and elevators, amid the flying chips of iron and steel in the metal-working industry, and on many other difficult jobs.

That's why so many motor users insist on Fairbanks-Morse Motors . . . and that's why you can specify them with assurance of satisfaction.

Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

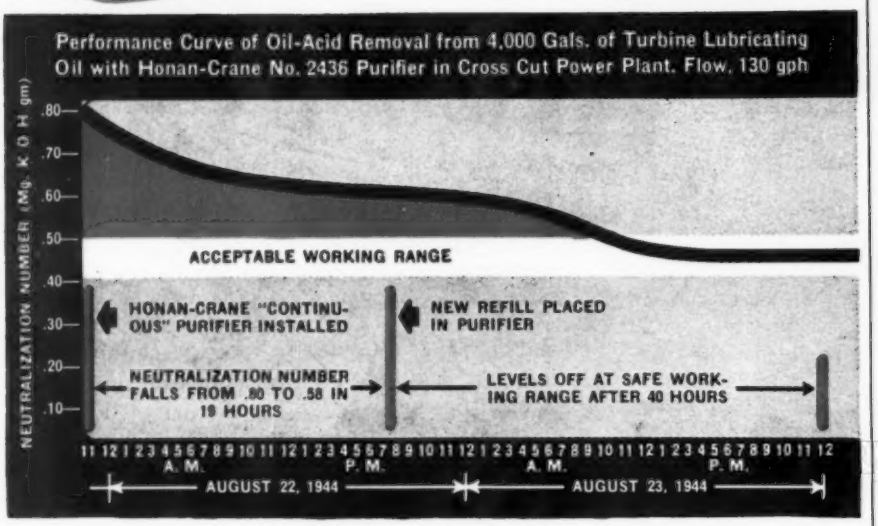


## Fairbanks-Morse

*A name worth remembering*

**Diesel Locomotives • Diesel Engines**
**Scales • Motors • Pumps • Generators**
**Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment**

# HONAN-CRANE "CONTINUOUS" OIL PURIFIER GOES IN— NEUTRALIZATION NUMBER GOES DOWN

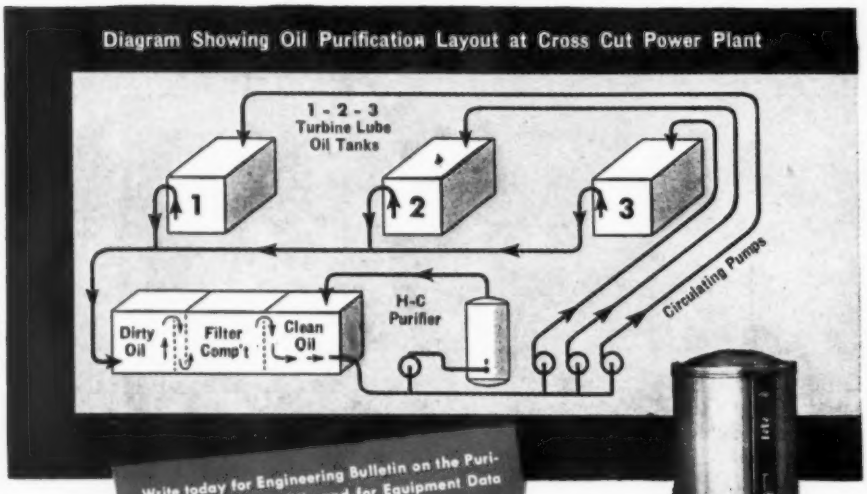

Performance Curve of Oil-Acid Removal from 4,000 Gals. of Turbine Lubricating Oil with Honan-Crane No. 2436 Purifier in Cross Cut Power Plant. Flow, 130 gph
NEUTRALIZATION NUMBER (Mg. K O H gm)
.80
.70
.60
.50
.40
.30
.20
.10
ACCEPTABLE WORKING RANGE
HONAN-CRANE "CONTINUOUS" PURIFIER INSTALLED
NEW REFILL PLACED IN PURIFIER
NEUTRALIZATION NUMBER FALLS FROM .80 TO .58 IN 19 HOURS
LEVELS OFF AT SAFE WORKING RANGE AFTER 40 HOURS
11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
A. M.
P. M.
A. M.
P. M.
AUGUST 22, 1944
AUGUST 23, 1944

• In August, 1944, in the Cross Cut Power Plant, Tempe, Arizona, the neutralization number of the 4,000 gallons of Turbine Oil in service suddenly jumped to unsafe limits with resultant sludging.

The cause was found and corrected, but the damage had already been done to the oil. To replace the oil would have cost $3,000.

On August 22 a Number 2436 Honan-Crane Purifier was added to the oil purification system and quickly restored the oil to a proper working condition (see chart above), at a cost of $75. The oil is still in service and is maintained in perfect condition at a cost of $50 per year. These facts are taken from a report prepared by Clyde Williams, superintendent.

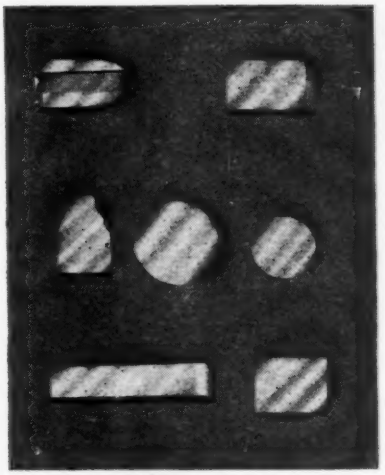
Honan-Crane "Continuous" Oil Purifiers furnish safe protection for any turbine by removing all abrasives as well as acids and other soluble contamination.



Write today for Engineering Bulletin on the Purification of Turbine Oils and for Equipment Data on Honan-Crane "Continuous" Oil Purifiers.

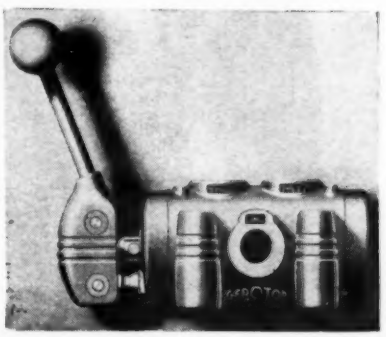
**HONAN-CRANE CORPORATION**
1200 Sixth St., LEBANON, IND.
**Subsidiary of HOUDAILLE-HERSHEY CORP.**


that "charges" *Drainmaster* (2) auto-tire valve for use with air hose if available (3) gage showing pressure in air chamber (4) release button (5) stainless-steel outer jacket. **Locke Regulator Co, Walter & Osborne St, Salem, Mass.**



## Electrical Contacts

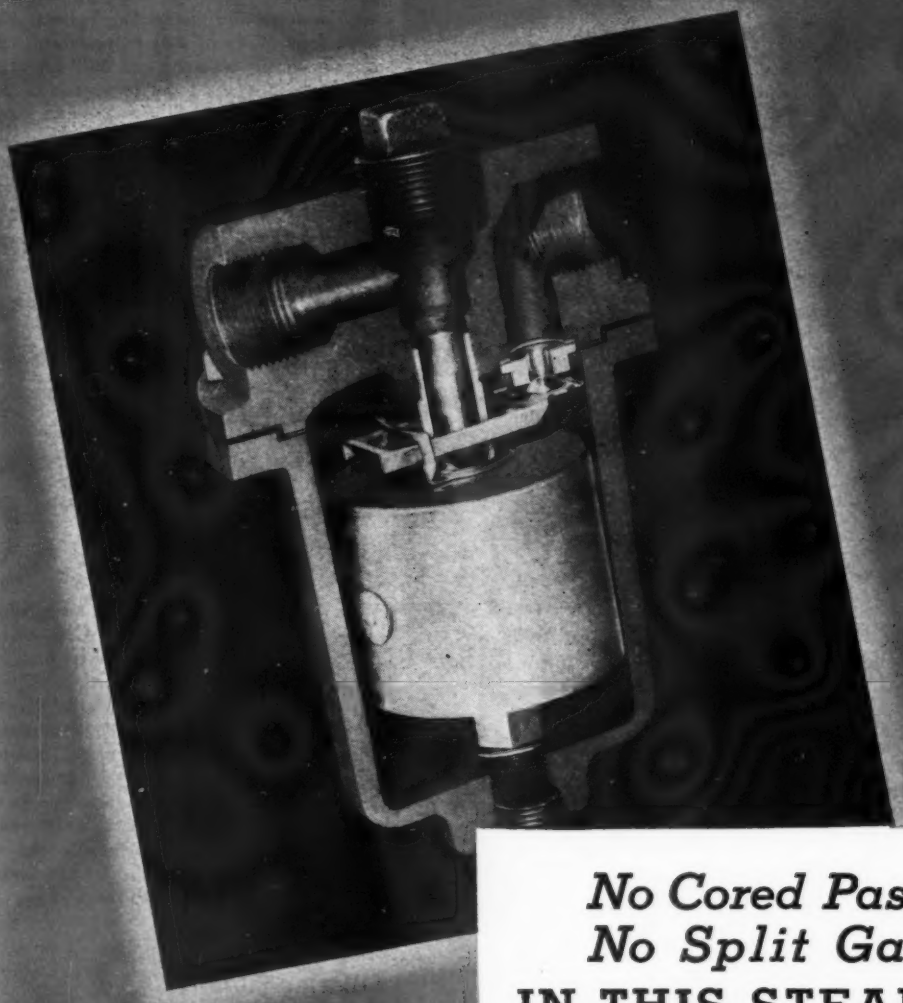
CHARACTERISTICS OF GIBSILOY electrical contacts made from silver tungsten and silver tungsten carbide include, according to maker, high current-carrying capacity, improved resistance to welding and long life. On an air-circuit breaker a contact with less than 1/6 sq in. of contact area can repeatedly break 15,000 amp circuits at 600 v, without sticking, welding or excessive wear. Made by a special process from metal powders, these electrical contacts comprise a combination range in the silver-tungsten series from 10 to 80% tungsten and in the silver-tungsten-carbide series from 20 to 80% tungsten-carbide, with hardnesses from 80 to 100 Rockwell B. **Gibson Electric Co, 8362 Frankstown Ave, Pittsburgh, Pa.**



## Hydraulic Valve

GEROTOR 4-WAY HYDRAULIC VALVE has a "floating piston" design that permits close fitting of piston in valve bore and gives maximum sealing ability. Valve stem is supported in its bearings in valve covers without any influence on piston fit in valve body. *O* ring-seal design prevents exhaust oil from leaking past piston stem. Likewise an *O* ring seal on valve covers assures positive sealing with no gasket.

This valve is suitable for oil service with pressure up to 1500 psi and can be furnished for 2500- to 3000-psi oil service. For high-



## *No Cored Passages*
## *No Split Gaskets*
## IN THIS STEAM TRAP

Look at this cross-section view of a Super-Silvertop Steam Trap! You can *see* that there are no cored passages (subject to casting defects which restrict the flow), no split gaskets to threaten steam leaks. It's no *wonder* Super-Silvertops give long, dependable trouble-free service! This engineered steam trap was the first to provide simplified piping on inverted bucket traps, and is still the *only* inverted bucket trap to offer simplified piping without cored passages and split gaskets. In addition, Super-Silvertop provides economical, neat piping BOTH ways—either elbow or straight-in-line.

If you want a steam trap of long life and trouble-free operation, plus special time and money-saving features, investigate Super-Silvertop. A free book, "How to Choose a Steam Trap" is yours for the asking—write today.

**THE V. D. ANDERSON COMPANY**
**1934 WEST 96th STREET • CLEVELAND 2, OHIO**

# Super-Silvertop
## STEAM TRAPS

SAVE by using B-H MONO-BLOCK

One-block insulation
for ALL temperatures up to 1700° F.

The use of a single material reduces installation time and costs. Mono-Block is strong, yet light and easy to cut, whether in straight lines or in odd shapes. It yields readily to rivet heads or other irregularities of surface. It can be applied easily and quickly.

Mono-Block is not molded; it is *felted* by a patented B-H process. Instead of being a conglomerate of compressed nodules, it is an interwoven structure of long, straight fibres with millions of dead-air cells which are efficient barriers to heat.

These fibres, moreover, are B-H *black* Rockwool, unusually resistant to moisture as well as to heat. This means that Mono-Block is long-lasting—stable even under severe conditions of temperatures and humidity.

* * *

*The coupon below* will bring you a sample and full information, including the wide range of sizes and thicknesses.

**Baldwin-Hill**

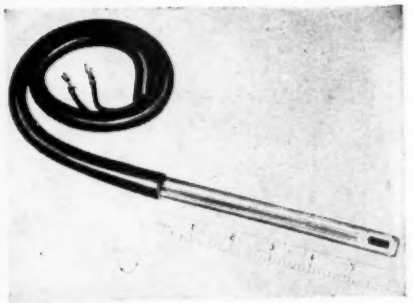
**SPECIALISTS IN THERMAL INSULATION PRODUCTS**

Baldwin-Hill Co., 558 Klagg Ave., Trenton 2, N. J.
*Send information on products checked below:*

- ☐ Free sample of B-H No. 1 Cement
- ☐ No. 100 Pipe Covering—effective up to 1200° F. (for long runs overhead, underground, Diesel exhausts)
- ☐ Mono-Block—the one-block insulation for all temperatures up to 1700° F.
- ☐ Black Rockwool Blankets (felted between various types of metal fabrics)

NAME _____ POSITION _____
FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

pressure water service, valve can be supplied with noncorrosive materials. Valve is offered with four kinds of action: standard, spring return, spring centered and ball detent; five piston designs; six types of operation: hand, foot, cam, solenoid, oil-pressure and air-pressure operated: seven sizes: ¼, ⅜, ½, ¾, 1, 1¼ and 1½ in. **Gerotor May Corp, Logansport, Ind.**

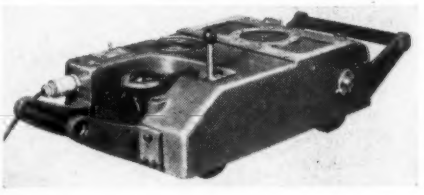


## Dip Cell

MICRO CONDUCTIVITY DIP CELL tests solution of as little as 5 cc in a tube. Cell, made of Pyrex glass, measures ½ in. OD by 6 in. long. Flexible rubber sleeve protects lead wires. Cell is particularly convenient in checking solutions in small original containers or sample bottles. A selection of cell constants from 0.1 up permits checking of any solution ranging from pure distilled water to fuming sulphuric acid, when cell is employed in combination with a suitably calibrated solubridge or a conductivity bridge. **Industrial Instruments, Inc, 17 Pollock Ave, Jersey City 5, N. J.**

## Filtering Material

ADSTAY (CELLULOSE) FILTER DISKS are now available for *Hilco* oil reclaimers and *Hilco Hyflow* oil filters for purifying additive, detergent or inhibited oils. This material can be employed in the units now in the field without making any mechanical changes. **Hilliard Corp, Elmira, N. Y.**



## Machine Carriage

HEAVY-DUTY, compact, strong Oxweld-Unionmelt CM-37 machine uses high-strength aluminum alloys and has over-all dimensions 32x12½x9 in.; total weight without auxiliary equipment is 87 lb. Ac-operated 110-v unidirectional motor, ¼ hp with reversing gears, permits speeds of 2 to 50 in. per min in general industrial use and 7 to 210 in. per min with Unionmelt welding process.

Two calibrations on an electric speedometer provide control for operation on track or work-piece. Greater accuracy develops from use on CM-21 track but where not important it can operate on a standard 10 in., 25.4 lb I-beam directly on a flat work-

(*Continued on page* 154)

# Guaranteed for the life of your turbine ...and longer

*for 18 years*

**NONPAREIL**
**TURBINE OIL**

**... 18 years' experience with an inhibited turbine oil makes it possible to guarantee Nonpareil indefinitely against excessive acidity**

Nonpareil Turbine Oil has been in use by turbine operators for 18 years. Original "fills" of oil are still operating, either in the turbines in which they started or in newer units. That's because Nonpareil Turbine Oil is *guaranteed for the life of a turbine.* But more than that, it can be taken from one turbine after years of service, put into a newer unit, and again it will be guaranteed for the life of the new turbine. In effect, Nonpareil lasts forever.

Here's what this means to you. Once installed, Nonpareil eliminates all cleaning of turbine oil systems. It eliminates the need for removing and treating or resting oil. It eliminates the hazard of high oil acidity and the attendant deposit formation and poor oil demulsibility.

Switch to Nonpareil—an oxidation and corrosion inhibited oil with an 18 year record for reducing turbine oil maintenance. A Standard Oil Lubrication Engineer will be glad to discuss with you the Nonpareil guarantee and its many advantages. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

**STANDARD OIL COMPANY (INDIANA)** STANDARD SERVICE

# What qualities to look for in cost-saving greases

QUALITIES that reduce wear on bearings and gears . . . that stop excessive consumption . . . that cut oiler time for servicing equipment . . . these are the qualities you want in a grease. What they are and how you can get them is described in a booklet illustrated at right.

Many of the advantages, which you would expect to find only in special purpose, premium priced greases, are available in a line of 11 grades—including high-temperature greases—called

**SUPERLA GREASES**

## Send for this Booklet

It tells how the most desirable qualities have been incorporated in a complete line of grease to reduce costs on a wide range of Industrial application.

It also has hints on hand packing anti-friction bearings and avoiding over-lubrication.

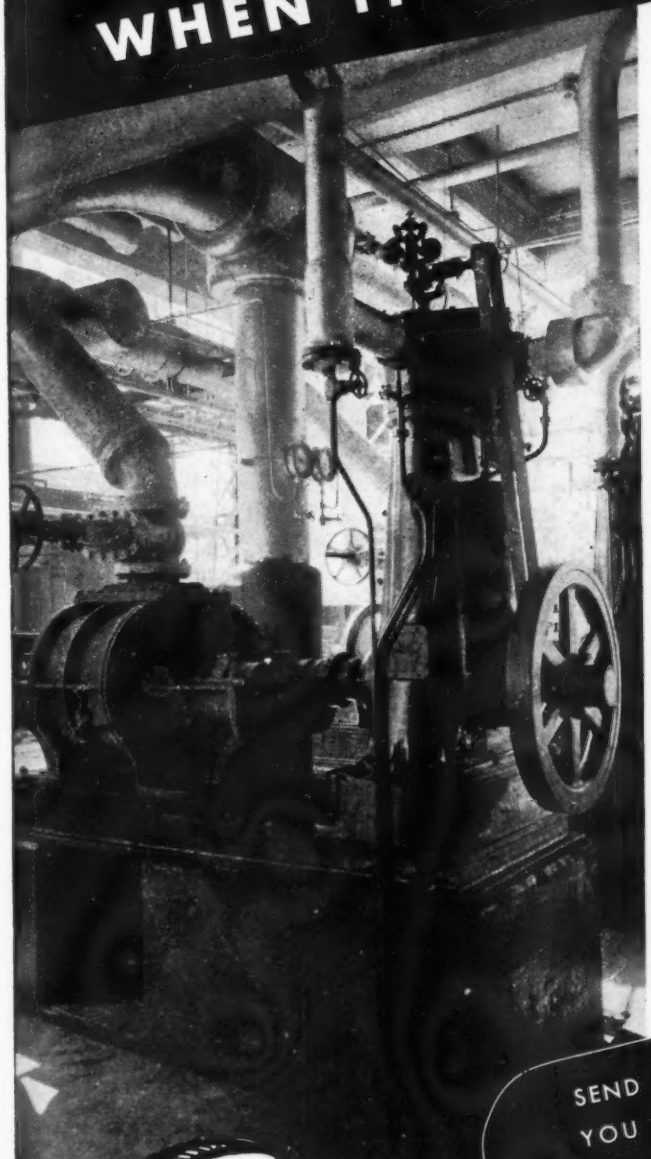
You can get a copy from the Standard Oil Industrial Service Representative who calls on you or by writing Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

**STANDARD OIL COMPANY (INDIANA)**

STANDARD SERVICE

TROY-ENGBERG
STEAM ENGINE

# POWER IS MOST MODERN WHEN IT HAS LOWEST COST



The Troy-Engberg Steam Engine is industry's By-Product Power drive and for many plants it could be their most modern equipment . . . producing power at very low cost since the exhaust carries such a high percentage of the heat units needed for heating or processing.

In many plants the Troy Engine is producing power at a cost well under that of any other unit. In fact, it often pays for itself completely within a year or two, driving such commonly-used equipment as stokers, compressors, blowers, pumps, generators, fans, cookers and dryers.

We suggest that you investigate thoroughly the role the Troy Engine could fill in your plant. Steam for heating or processing and need for power are determining factors . . . if you have these requirements, you probably have a place for this modern steam engine.

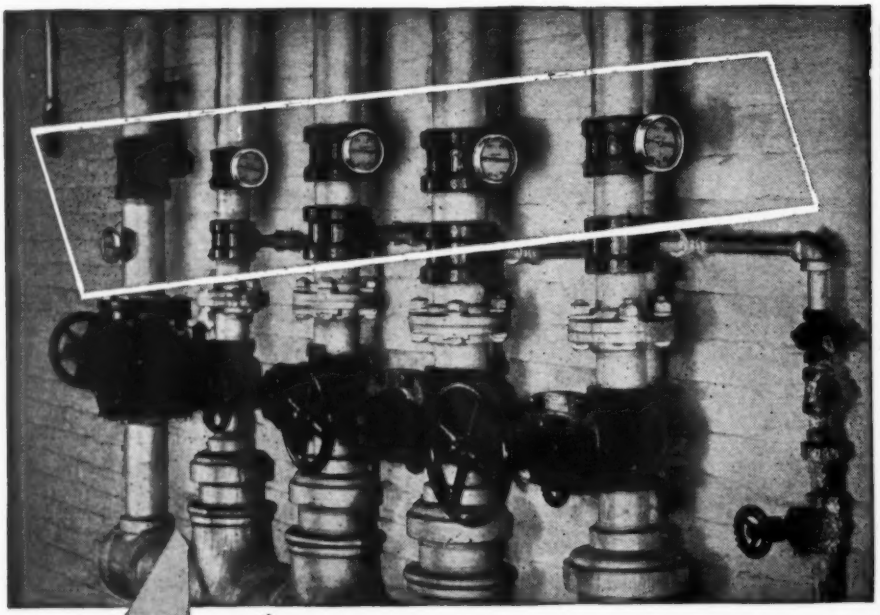
**TROY ENGINE & MACHINE CO.**
*Established 1870*
**2513 RAILROAD AVE., TROY, PENNSYLVANIA**

SEND FOR OUR BULLETIN 306. IT WILL GIVE YOU ESSENTIAL INFORMATION ABOUT THE TROY-ENGBERG STEAM ENGINE.

BULLETIN
306

# TROY-ENGBERG

STEAM ENGINES • GENERATING SETS • GENERATORS



# 4 Temperature Readings... at one glance!

**WITH READABLE, RELIABLE**
**WESTON *ALL METAL* THERMOMETERS**

Readability does it... whether its single or multiple temperature readings... in dark corners, in hard-to-get-at places, or spots high overhead... Weston All-Metal Industrial Thermometers are "kind to the eyes". Their bold, gauge-type scales are quickly and accurately read, even a distance away.

And for accuracy and all-round ruggedness, too, you can depend on their sturdy, yet simple, all-metal construction. The only moving part is the all-metal temperature element—and that is safely enclosed in a stainless steel stem. Thus the high initial accuracy of the WESTON thermometer... within 1% over the entire scale... is maintained over long periods; despite shock, vibration or other severe usage. Literature gladly sent on request... Weston Electrical Instrument Corporation, 679 Frelinghuysen Ave., Newark 5, N. J.

Available in stem lengths from 2½" to 48" . . . ranges from + 1000° F to — 100° F ... scale lengths 6", 9", 12".

**Weston *all Metal* THERMOMETERS**

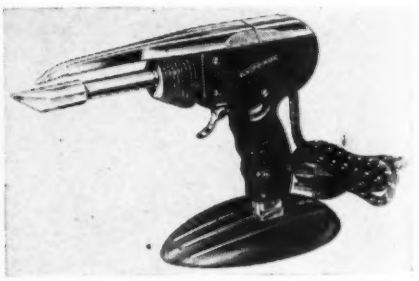

piece. With addition of accessory equipment for plate-edge preparation, flame-hardening, heavy cutting and similar duties, unit becomes more flexible. **Linde Air Products Co, Union Carbide and Carbon Corp, 30 E 42nd St, New York, N. Y.**

## Fire Instruction Cards

SERIES OF CONCISE, comprehensive instruction cards explain handling, operating and maintaining of four hand fire extinguishers. They cover the foam, soda-acid, vaporizing liquid and carbon-dioxide models. Clear photos accompany text. These cards, mounted adjacent to extinguishers they illustrate, provide a constant and accurate guide to plant employes. Write direct for free cards. **American - LaFrance - Foamite Corp, Elmira, N. Y.**

## Rubber Filtering Material

GOVERNMENT AUTHORITIES have allocated natural rubber for filtering material and full production is expected to get under way now. Material consists of rubber sheeting with as many as 6400 holes to the sq in. It is highly resistant to corrosion and wear, according to manufacturer, and has a low maintenance cost. **U. S. Rubber Co, Rockefeller Center, New York, N. Y.**



## Soldering Iron

EJECT-O-MATIC, an automatic-feed, electric soldering iron, is trigger operated and ejects a measured amount of solder from a reel concealed in handle. A special retracting feature prevents melting of excess solder on heating tip. Actual amount of solder deposited each time the trigger is pulled is regulated by a micrometer adjusting wheel mounted in handle and easily accessible to

# Two Clues

## to Why A-C's Smooth-Running Electrifugal Pump is the Finest of its Kind!

**Clue No. 1:** One-piece shaft carries motor-rotor and pump-impeller on ball bearings—assures alignment and smooth operation. Cast bronze sleeve shields it from liquid being pumped.

**CLUE No. 2:** One-piece iron casting forms motor yoke, the bearing housing, pump bracket and feet—gives stability to entire unit. Saves 33% space, lessens chance of strain on parts or piping.

FINE ENGINEERING adds up to quality and value—and that's what Allis-Chalmers "Electrifugal" Pump now offers you! Entire unit is designed for efficient, dependable service—gives you maximum protection against dangers of abnormal wear, leakage, corrosion, vibration. For further information call our nearby office, or write ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 1929

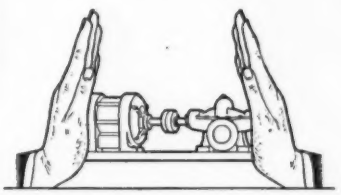
**HEAR THE BOSTON SYMPHONY:** *Every Saturday Evening, American Broadcasting Co.*

## OIL COMPANY BUYS 100 *Electrifugal* PUMPS

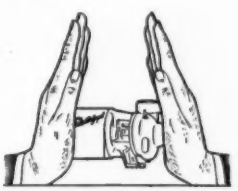
TO MOVE volatile liquids such as gasoline, kerosene, naphtha from tank-car to storage tank, and into trucks—a large petroleum company depends on A-C Electrifugal Pumps. Try-out of first 15 pumps was so successful (big test: surge-shock when valves snap shut!), 100 units were ordered, more later re-ordered.

Electrifugal Capacities: 15 to 1600 gpm—heads up to 500 feet.

### SQUEEZE PLAY CUTS PUMP SPACE 33%



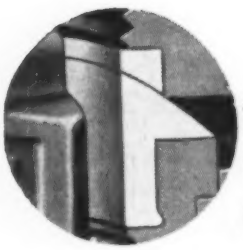
How can we couple a pump and motor together *better*—to save space, provide stability, rigid alignment?



Electrifugal Design assures alignment and smooth operation, cuts space 33% — gives you greater pumping efficiency for your money!

## ALLIS-CHALMERS *Electrifugal* PUMPS

# It's Hard to Damage



**TWO BRONZE SEATS GROUND TO A TRUE BALL JOINT PERMIT EASY CLOSING AND OPENING**

**Because the two bronze seats in a Dart Union close to form a true ball joint, ruinous wrenching is unnecesary. And if the union is needed for some other service, uncoupling is effected with equal ease. Body and nut are of high-test air-refined malleable iron—are practically indestructible. That's why Dart Unions are cheapest in the long run.**

***Next time your supplier calls, ask to see the Dart Union construction.***

**E. M. DART MFG. COMPANY**
**PROVIDENCE 5, RHODE ISLAND**

**DART**
**UNIONS**


operator's thumb. If, during course of job, more or less solder is required, a touch of wheel changes amount ejected.

When resting on special stand the iron can be moved forward through an angle of 45 deg, thus providing a firm foundation for operator when doing fine work. Trigger extension is available to enable operator to work iron on stand, leaving both hands free to hold work. **Multi-Products Tool Co, 123 Sussex Ave, Newark, N. J.**

## Rust Remover

MANUFACTURER HAS COMPOUNDED a product to (1) wet metal thoroughly (2) dissolve rust scale rapidly (3) remove it completely and (4) be relatively noncorrosive to steel even under long exposure. Rust remover may be applied by usual methods, such as brush, spray and dip, but its long life and rapid action in otherwise inaccessible crevices make dipping the most economical wherever practicable. **Nox-Rust Chemical Corp, Chicago 8, Ill.**

## Pressure-Seal Valves

NEW LIGHTWEIGHT VALVE LINE is for high-pressure high-temperature steam service, primarily in the 1500- and 900-psi classes, with welding ends, and embracing gate, globe and angle, and automatic stop-check valves. Pressure-seal bonnet joint utilizes the pressure in valve to seal the joint and to eliminate leakage. This joint can be taken apart and reassembled easily.

Gate valves have new disk design, which has built-in flexibility. This feature eliminates sticking of disk and requires less torque for opening when valve is cold after having been closed while hot. These disks have *Stellite* facings. **Crane Co, 836 S Michigan Ave, Chicago 5, Ill.**

## Air Appliance

LOGAN R-F-L UNIT for pneumatic equipment performs triple service of regulating air pressure, filtering and automatic lubrication. It includes in one casting, measuring 6x6x4¼ in., all individual components by which these things are usually done. Unit is interposed in the air-supply line serving the machine and may be mounted either on or convenient to it or on a central control board. All neces-

# the SAFE WAY to cope with FOULING and LOAD FLUCTUATIONS

## IN COOLERS FOR OIL, WATER AND OTHER LIQUIDS

ROSS

To operate continually at desired performance, a cooler *must* incorporate factors of safety to allow for the effects of fouling, as well as fluctuations in load and operating conditions. Otherwise, performance can drop below practical limits, and shutdowns can be excessive.

Ross *always* stresses a thorough analysis of the fouling tendencies of the fluids being circulated, the velocities to be maintained, temperature ranges and anticipated fluctuations in load as well as changing climatic or operating conditions . . . *and in your particular installation, you may prefer to avail yourself of Ross' experience in determining and analyzing your operating problems.*

This service, cheerfully given by Ross Engineers, assures the selection of a cooler best suited to your needs. Remember—your conditions can be met exactly by Ross, through the tailor-made features of Types "CP" and "BCF" Coolers, for large and small requirements, respectively.

THESE BULLETINS WILL HELP YOU

"CP" COOLERS No. 5322

"BCF" COOLERS No. 4922

Ross equipment is manufactured and sold in Canada by Horton Steel Works Ltd., Fort Erie, Ontario

**ROSS HEATER & MFG. CO., INC.**

Division of American Radiator & Standard Sanitary Corporation

1415 WEST AVENUE BUFFALO 13, N. Y.

# STICKLE VALVES

## FOR CLOSE CONTROL WITH ACCURATE REGULATION

Single seated, balanced, lever and weight loaded, diaphragm valves—also balanced lever valves—for low to high pressures. Same design in double-seated, semi-balanced construction.

Semi-balanced, double-seated lever valves for low and high pressures. Seats beveled and ground in, eliminating sticking and leaking of pistons.

A small (three sizes) spring balanced valve of exceptional merit for standard services on water, steam or air.

Double seated, unbalanced type, back pressure release valve. Can be supplied to suit various pressures without excessive weighting.

Pilot operated valves, with five designs of Pilot Control Valves, to meet various operating pressure requirements.

● If you have a problem of close control with accurate regulation, use Stickle Valves. Stickle Valves were developed especially to meet the requirements of complicated pressure regulation—for service where exacting control is necessary—to obtain the extreme sensitivity for automatic control with fractional variations in pressures. Made in single-seated and double-seated series, balanced and semi-balanced in sizes small to large, to meet most industrial requirements. Ask for Bulletin Nos. 235 and 435 for full descriptions and data on complete line.

**Other Specialties Including Steam Traps, Drainage and Boiler Return Systems, Feed Water Heaters, Oil and Steam Separators.**

**STICKLE STEAM SPECIALTIES COMPANY**

**2265 VALLEY AVENUE, INDIANAPOLIS 1, INDIANA**

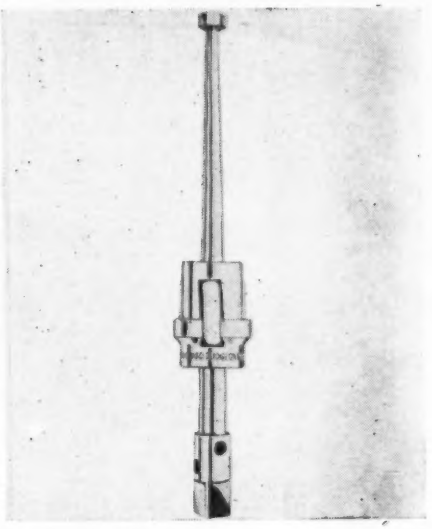
***SPECIALIZING FOR MORE THAN 40 YEARS IN REDUCING THE COST OF STEAM***


sary connections are built into the casting and controls, gages, etc, are on a front panel.

Two knobs adjust air pressure and amount of oil introduced. Third knob controls opening of a drain on a reservoir into which condensed moisture drops after it has been separated from the air by filter. Filter itself, of porous metal, is readily removable for cleaning or replacement. R-F-L unit serves with air pressure up to 150 psi. **Logansport Machine Co, 910 Center Ave, Logansport, Ind.**

## Soft Hammers

TWO NEW MODELS of soft hammers in light-sledge weight range have been added to *Perfect Balance* line. One has a replaceable copper or brass head, the other replaceable brass or copper tips. Each model comes in 1¾, 2, 2¼ and 2½ in. sizes (dia of head) and weighs from 4½ to 10½ lb. Hammers are equipped with a safety leather-washer handle. Steel head on removable-tips model is case hardened. **Gregory Tool & Mfg Co, 5300 Tireman, Detroit 4, Mich.**



## Tube Expander

MODEL 16 DUDGEON TUBE EXPANDER serves for all general boiler work, railroad maintenance, boiler making and repair. It has been designed with a minimum of parts—frame, rolls and mandrel. Expander may be readily dismantled and new rolls quickly inserted. They are set at an angle with mandrel for self-feed. Reversing the mandrel releases expander from tube. Model 16 expanders are compact, which permits them to work close to boiler shell, rivet lines or tubes grouped together. They are furnished for hand or combination hand-and-power use. **Richard Dudgeon, Inc, 24 Columbia St, New York 2, N. Y.**

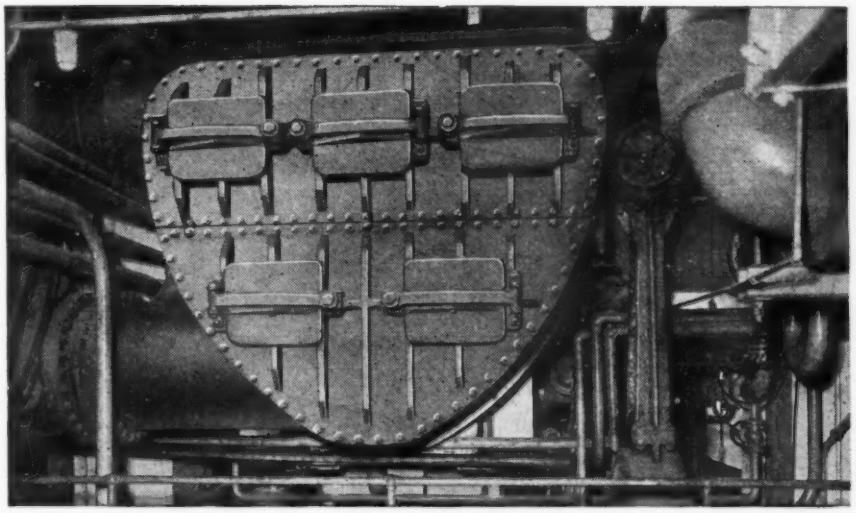
## Gasketing

CHROME LOCK GASKETING offers adhesion to metals without cementing gasket to flange. Adhesive back makes it unnecessary to tie, lace or tape gasket onto vertical or inverted flanges. *Chrome Lock* gasketing can be finger-pressed onto the surface and, it is claimed, will "stay put." Adhesive-back gas-

ADVERTISEMENT—This entire page is a paid advertisement

# ATLANTIC CITY UTILITY Completely Modernizes Plant

## Second Hydrogen-Cooled Generator Unit Being Installed



Surface-type steam condenser at Atlantic City Electric Co. With a total of 17,000 sq ft of tube surface, this unit condenses more than 200,000 lbs of steam per hr.

## Ingersoll-Rand Condensing Plants Serve New High-Pressure Turbines

ATLANTIC CITY ELECTRIC COMPANY, an American Gas and Electric Company subsidiary, serves not only New Jersey's amusement and resort center but one of the fastest-growing industrial centers in south Jersey. The growth of this load, as well as that of Atlantic City proper, has called for two expansions of Atlantic City's generating facilities within the last few years.

Two complete generating units, each of nominal 25,000 kw rating, complete the present modernization program. These units are known as Generators No. 6 and No. 7, respectively. No. 6 is now on the line, and No. 7 will go into service next year.

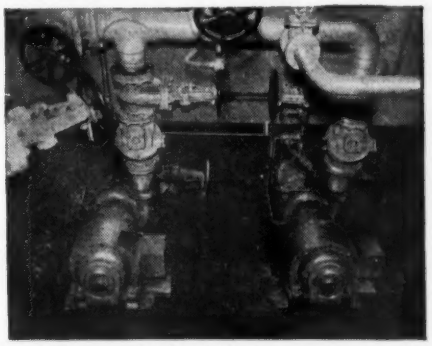
Each installation is a separate and independent unit, and has its own boiler plant, condenser equipment, and pumping facilities. Each unit has an extraction-type turbine, a hydrogen-cooled generator, and a new water-tube and water-wall boiler. Steam for the second unit will be supplied at 1000°F and 1400-psi. Ingersoll-Rand high-efficiency surface-type steam condensers and air-removal equipment were ordered for both turbines.

Ingersoll-Rand Company has been manufacturing steam condensing apparatus and related equipment for many years. The most careful attention has been consistently devoted to the needs of utility stations, marine power plants, and process industries.

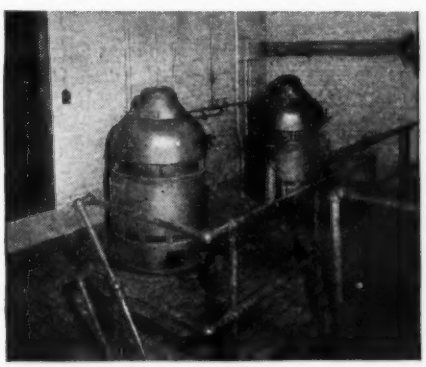
Surface condensers have been built in sizes ranging from 200 to 160,000 KW in capacity and operate successfully under a wide variety of conditions in both domestic and foreign land and marine power plants. The equivalent prime-mover capacity for which Ingersoll-Rand condensers have been provided, is over four-million kilowatts.

Ingersoll-Rand pioneered the high efficiency condenser over twenty years ago, and since that time has maintained leadership by following a continuous program of development which is aided by exceptional facilities for accurate testing and full scale experimental work.

There is an Ingersoll-Rand condenser for every size and type of turbine. Many recent orders have been for the complete condensing plant, including the condenser, air removal equipment, circulating water pumps, condensate pumps, and auxiliary pumps. Ingersoll-Rand condenser specialists are ready to help with your problems.



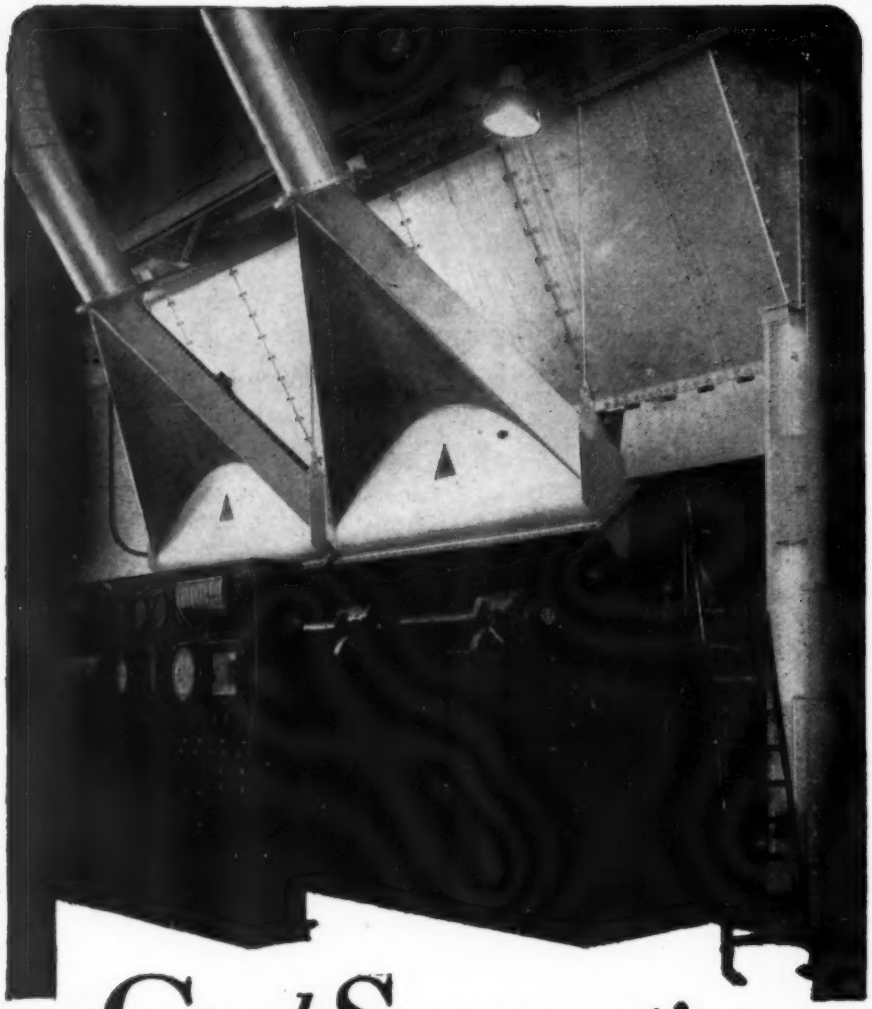
Two Ingersoll-Rand Motorpumps handle condensate from the primary hotwell below the steam condenser. Each pump can handle 500 gpm against a head of 110 ft.



Vertical propeller-type pumps deliver up to 16,000 gpm cooling water to the surface condenser. These are 100-hp units.

• • ● • •

**Ingersoll-Rand, 11 Broadway, New York 4, N.Y.**



# Coal Segregation

## CAN BE ELIMINATED!

*S.E.Co. CONICAL Coal Distributors are the answer!*

Better fires on the stoker are an assured result if coal is fed to the stoker without segregation of coarse and fine pieces. S. E. Co. CONICAL Non-Segregating Coal Distributors are designed to deliver a uniform mixture to the stoker . . . consequently combustion is uniform, the greatest possible amount of power is extracted from the fuel and excessive maintenance of stoker arches and grates is eliminated.

***Write for further information on the CONICAL Distributor. Address Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio.***

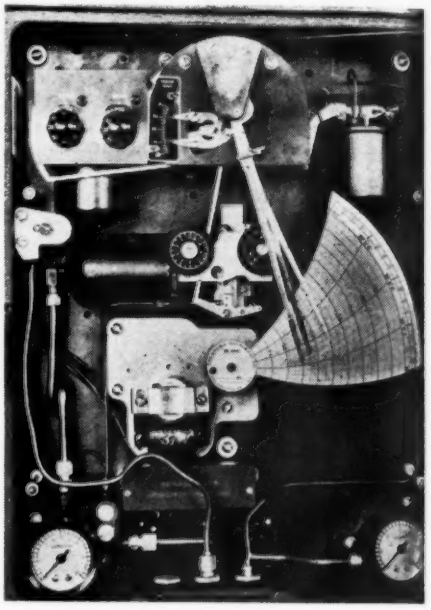
STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★

S.E.CO. Coal Valves and Coal Scales

kets have a crinoline liner upon which template may be laid and either scribed or marked with an ordinary lead pencil. Quantities of gaskets may be cut at one time and with liner left in place, stacked in parts bins without danger of sticking together or collecting dirt and filings. Liner also serves to stabilize gasketing during cutting operation.

*Chrome Lock* gasketing is supplied in four models, No. 8 and 16 without the adhesive back and No. 8A and 16A with adhesive back. This gasketing is packed in both rolls and slit rolls. **Products Research Co, Dept A106, 634 S Western Ave, Los Angeles 5, Calif.**



## Process Control

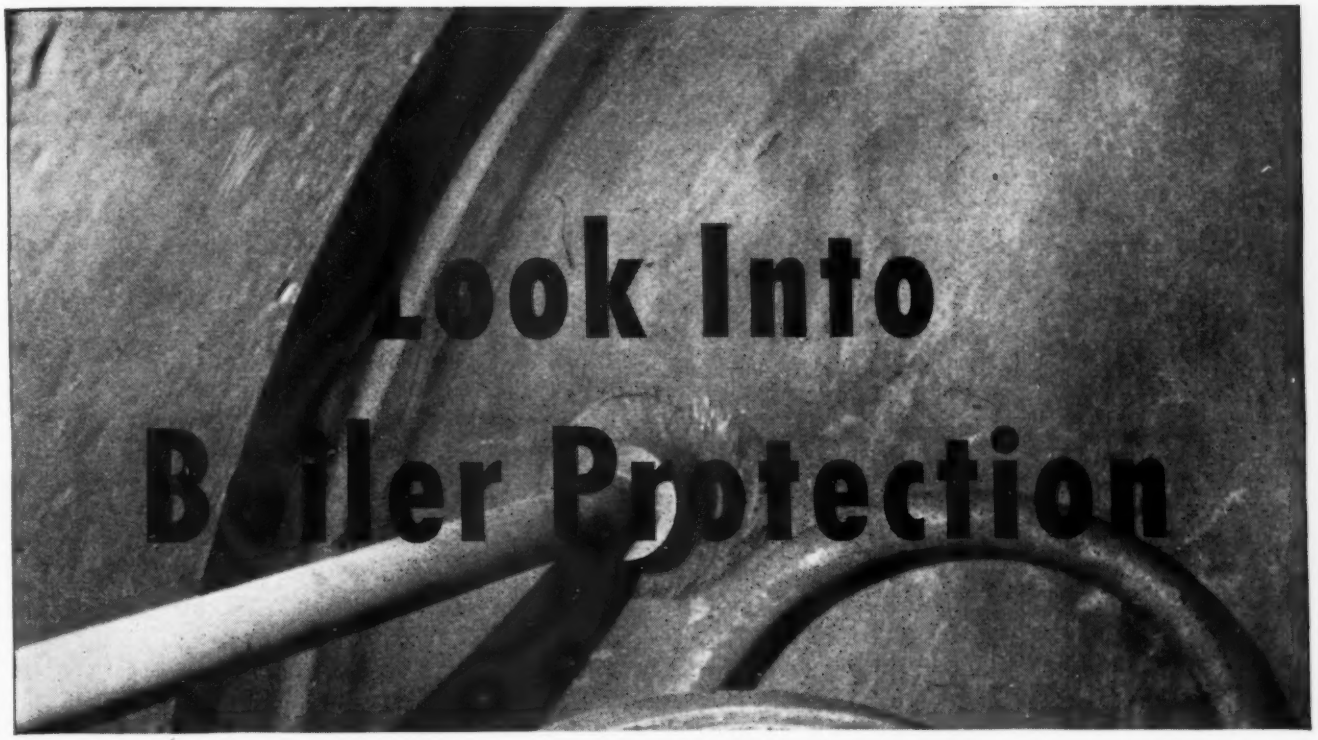
ADJUSTABLE, ACCURATE, easy control for process work constitutes manufacturer's claims for a new device known as the *Adjustable Indexet. Indexet* features (1) span adjustment, 0 to 200% (2) zero shift adjustment, — 100 to +100 (3) readily accessible adjustments without chart or center-point disturbances (4) direct action (5) limit stops to control within desired limits.

Span or proportional adjustment serves as a multiplying or dividing operator on distance through which control points move under a full-scale change in pressure. Zero or linear adjustment adds or subtracts a constant value. **Brown Instrument Co, Philadelphia, Pa.**

## Riveting Hammers

PNEUMATIC RIVETING HAMMERS feature small size, light weight and rugged construction. The harder the hammer works the cooler it becomes, according to maker, because of the expansion of air, which is exhausted from front at operating head. Barrel is of one-piece all-steel construction with a reinforced end to take piston impact without breaking. Piston is made of hardened alloy steel.

An air-throttling regulator valve permits fine adjustment for all kinds of riveting, even on plain or heat-treated alloy aluminum, brass or soft iron. With proper tool, *Air-Horse* hammer also serves for calking, scaling,




*This high pressure boiler interior has been coated with APEXIOR NUMBER 1. The photograph, taken after more than five years of service, shows that no water or steam has touched the boiler metal.*

A thin, brush-applied film of APEXIOR NUMBER 1 provides positive, long-lasting protection for boiler interiors. Seeping into pores and joints, it seals off the metal surface from water and steam, effectively checking corrosion and embrittlement.

Corrosion may remain unknown and unchecked if left hidden under operating deposits. APEXIOR NUMBER 1, providing a wholly mechanical barrier, eliminates the tight chemical bonding of such deposits. Therefore, boiler maintenance is simplified — because the metal surface remains cleaner over longer periods, while its true condition is always apparent.

The tough, durable film of APEXIOR NUMBER 1, a few thousandths of an inch thick, does not retard heat transfer. On the contrary, by retarding heat-insulating layers of corrosion and sludge, it prolongs the period of high heat-transfer efficiency.

APEXIOR NUMBER 1 is applied to steam turbine shafts and rotor bodies at the factory, or during periodic inspections. It is equally effective on feedwater heaters and deaerators, Diesel engine removable liners, pump shafts and casings for high temperature boiler feed pumps, etc. Recommended by all U. S. and Canadian boiler insurance companies.

**APEXIOR NUMBER 3 — A Companion Product for "Cold-Wet" Metal**

Tanks, condensers, pumps, air washers, the submerged external areas of ships' hulls — all metal surfaces exposed to either fresh or salt water at temperatures up to 125°F. are given lasting protection with APEXIOR NUMBER 3. Tank applications are effective for every type of cold water supply, including drinking water.

Send the coupon below for free bulletin 1290, containing full information on APEXIOR brush-applied protective coatings.

*Two new high-temperature Dampney coatings are Thur-Ma-Lox Number 7 Black (1600°F.) and Thur-Ma-Lox Number 10 Aluminum (1200°F.). Properly applied, they provide lasting protection to dry metal surfaces subjected to the extreme temperatures indicated.*

**Representative long-term users of APEXIOR:**

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The Ohio Power Co.
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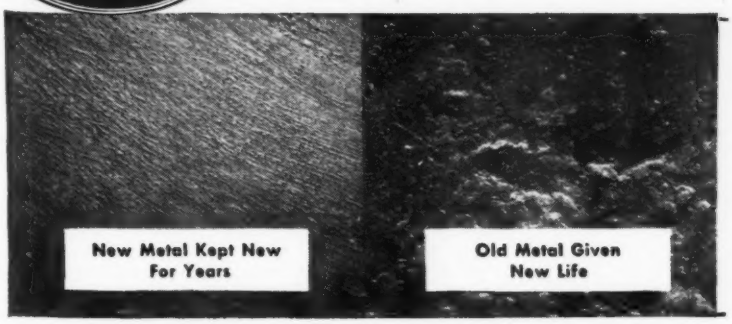
Cudahy Brothers Co.
Youngstown Sheet & Tube Co.
Board of Education, Salt Lake City
Port Houston Iron Works
Interlaken Mills
Jones & Laughlin Steel Corp.

APEXIOR — *Keeps new metal new . . . Gives old metal new life* — DAMPNEY




THE DAMPNEY COMPANY OF AMERICA
1231 River Street
Hyde Park, Boston 36, Mass.

Please send free Bulletin 1290.

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Company.....

Address.....

.....

*. . . for better piping jobs at lower cost*

*featuring the* **RECESSED BRASS SEAT**

# JEFFERSON Specialty UNIONS

The brass seating of all Jefferson Specialty Unions is an exclusive feature which has been improved over many years to make leakproof joints. It provides a *surface* contact and assures tightness without the necessity of jamming.

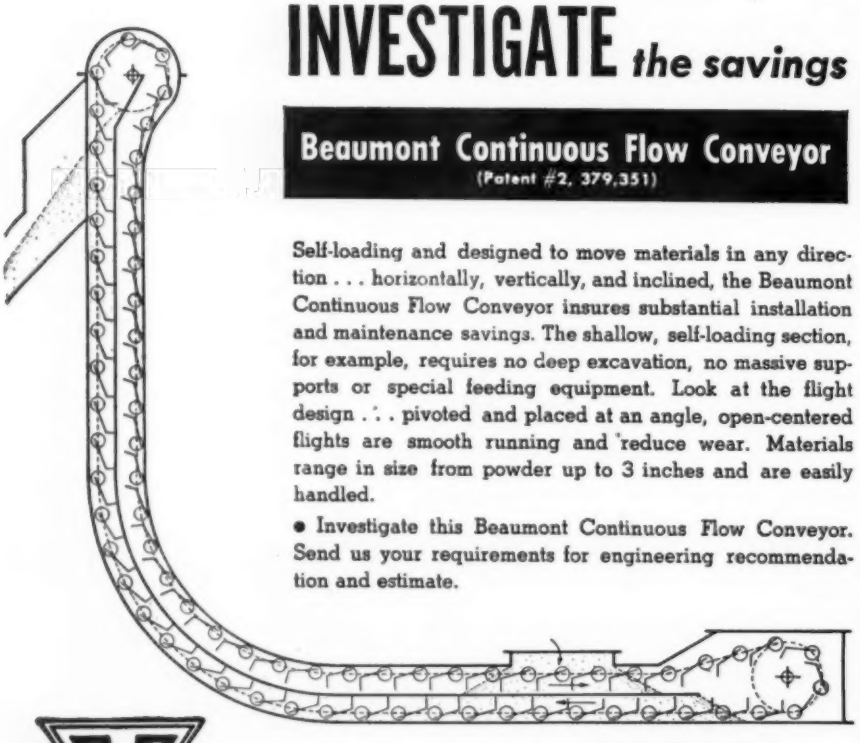
By incorporating this feature in Jefferson Specialty Unions, piping installations can be greatly simplified because fewer joints are necessary. Better and fewer joints result in savings in time for both installation and maintenance. In the case of the Jefferson Union Tee with union on the outlet as shown here, a saving of two nipples and an ordinary tee are realized, or the equivalent of three joints.

*Jefferson Specialty Unions, available in all types, will enable you to improve piping systems and reduce piping costs. Investigate TODAY . . . through us or your nearest distributor.*

**JEFFERSON UNION CO.**

**601 West 26th St., New York 1, N. Y.**
**LEXINGTON 73, MASS. LOCKPORT, N. Y.**





# INVESTIGATE *the savings*

**Beaumont Continuous Flow Conveyor**
(Patent #2, 379,351)

Self-loading and designed to move materials in any direction . . . horizontally, vertically, and inclined, the Beaumont Continuous Flow Conveyor insures substantial installation and maintenance savings. The shallow, self-loading section, for example, requires no deep excavation, no massive supports or special feeding equipment. Look at the flight design . . . pivoted and placed at an angle, open-centered flights are smooth running and reduce wear. Materials range in size from powder up to 3 inches and are easily handled.

• Investigate this Beaumont Continuous Flow Conveyor. Send us your requirements for engineering recommendation and estimate.

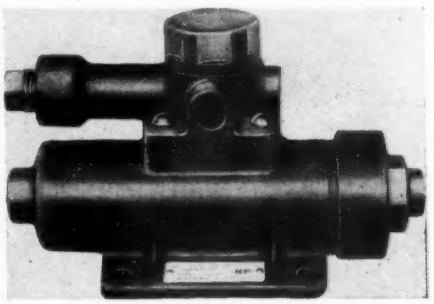
**BEAUMONT BIRCH COMPANY**
**1502 RACE STREET PHILADELPHIA 2, PA.**
DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS


chipping and other work. A beehive retainer spring is easily screwed on with fingers. Hammer is available with offset or grip handle in three sizes for light, medium or heavy riveting. **Ideal Commutator Dresser Co, 1025 Park Ave, Sycamore, Ill.**

## Shop Truck

BUDA CHORE BOY, Model FF, is a dual-wheel heavy-duty platform shop truck of one ton capacity. It has an extra large nonskid deck with a loading space of over 20 sq ft. It is provided with dual wheels to carry extra heavy loads.

Truck has an air-cooled 7.7 hp engine capable of speeds up to 15 miles per hr and with an economy of operation of 35 to 40 miles per gal of gas. It is equipped with trouble-free transmission of simple friction type and with heavy-duty roller-chain drive to rear axle. Heavy-duty pneumatic dual wheels are mounted on rear drive axle and bearings. **Buda Co, Harvey, Ill.**



## Water Ejector

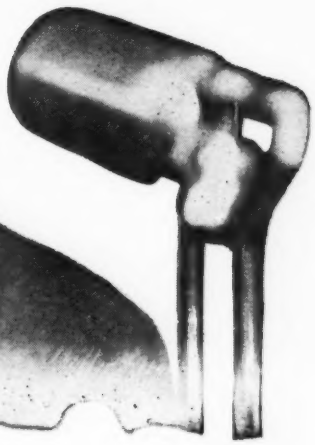
AUTOMATIC WATER EJECTOR does away with frequent manual draining of water separator and air lines. The ejector never connects the compressed-air system to atmosphere, according to maker, and therefore cannot cause any pressure loss. Occupying little space and mounted horizontally, ejector may be installed at any location where water is collected. Three connections of ¼-in. pipe are necessary: one to bottom of water collector, another to drain (for disposal of removed water) and third to an air line that is repeatedly charged and discharged, such as the "unloader line" of an air compressor, or solenoid valve controlled by compressor switch, or control valves on compressed-air equipment, etc.

With the ejector is furnished a ½x6-in. pipe and fittings, to provide a vertical sump of ample capacity for most water-removal applications. At 100 psi, 30 cycles discharge 1 qt of water. Greater quantities can be handled by simply lengthening the pipe. **National Pneumatic Co, 420 Lexington Ave, New York 17, N. Y.**

## Paint Indicator

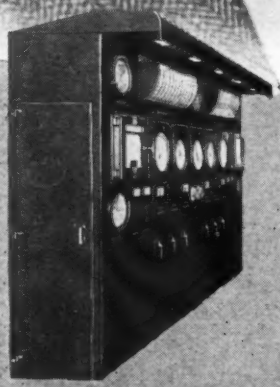
HANDY POCKET-SIZED aluminum paint indicator reveals (1) how to prepare any given surface before applying the paint (2) how many square feet of any given surface can be covered with a gallon of paint (3) kind of structures having the given surface, which is covered in detail for each surface where aluminum paint can be applied. Indicator has two sides—one side for interior appli-

# FLASH!



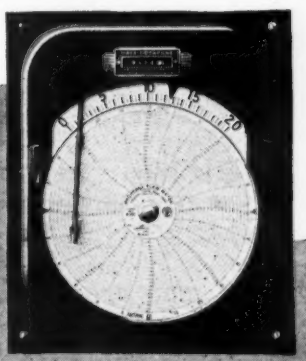
NOW A HAYS PRODUCT

EFFECTIVE JANUARY 1, 1946, COCHRANE FLOW METERS, FORMERLY A PRODUCT OF THE COCHRANE CORPORATION OF PHILADELPHIA, BECAME A PART OF THE HAYS LINE OF PRODUCTS AND WILL BE SOLD BY HAYS REPRESENTATIVES AS HAYS-COCHRANE INSTRUMENTS FOR FLOW, LIQUID LEVEL, PRESSURE AND TEMPERATURE MEASUREMENT.

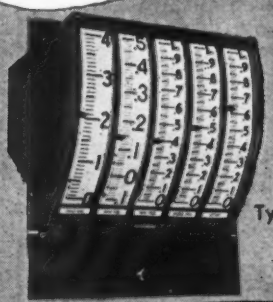


Automatic Combustion Control

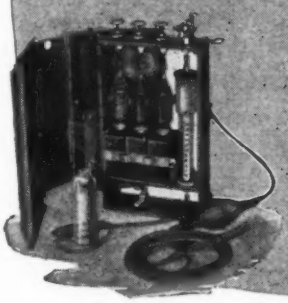
Combustion Meter



HAYS-COCHRANE FLOW METERS



Pointer Type Draft Gages



Flue Gas Analyzers

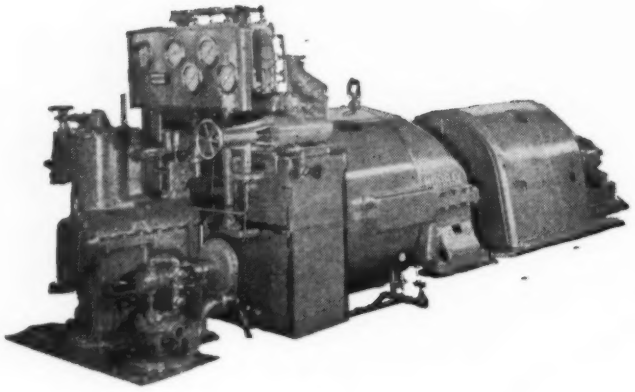
ALL FROM A SINGLE SOURCE—*CONVENIENT!*

The HAYS CORPORATION

COMBUSTION INSTRUMENTS AND CONTROL

MICHIGAN CITY, INDIANA, U.S.A.

# MURRAY
## STEAM TURBINE GENERATING UNITS



Installed in 1939 in a small municipal power plant in northeastern Indiana, the above 500 KW direct connected Murray steam turbine generator set has given its owners entire satisfaction. The turbine is equipped with every device necessary for minimum of attention including steam turbine driven auxiliary oil pump. The generator and exciter may be furnished to match existing electrical equipment in your plant.

Units in this size may be furnished either direct connected or geared as preferred with performance and operation equally trouble-free.

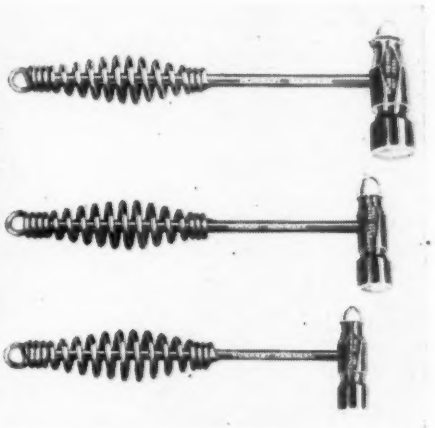
There is a Murray representative ready to help you with design and layout information.

**MURRAY *also produces***

**Mechanical Drive Turbines—Horizontal and Vertical Reduction Gears of the high speed type Steam Boilers**

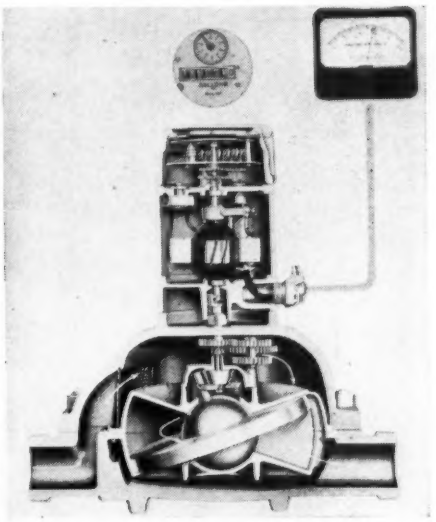
MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century


cations, the other for exterior applications. Address your request direct on business letterhead for available indicators. **Crescent Bronze Powder Co, 118 W Illinois St, Chicago 10, Ill.**



### Metal Hammers

BALL-PEIN HAMMERS are of all-metal construction. Heads are of alloy tool steel, flame-hardened for toughness. *Flex-O Handgrip*, shaped to fit the hand, absorbs shock of hammer blows. All-steel handle is unbreakable. Several models are available in a variety of sizes. **Atlas Welding Accessories Co, 14824 Wyoming Ave, Detroit 21, Mich.**



### Indicating Flowmeter

HAYS VERIFLOW, for measuring, indicating and totalizing various liquids, indicates flow rate at a point remote from where meter is installed. This is in addition to rate of flow indication and integrator, which are integral with the meter itself. To secure the remote indication, generator is mounted on top of flowmeter, the same shaft operating both generator and totalizing register. No external source of electricity is required because indicating meter measures generator output and is calibrated to indicate corresponding liquid-flow rate through the meter. Scale of indicator may be calibrated to read in any values of flow desired, such as gal per min. **Hays Corp, Michigan City, Ind.**

ENGINEERING HALL, UNIVERSITY OF ILLINOIS

# *A Leading University*

## USES BUELL FLY ASH PROTECTION

POWER PLANTS throughout the industries and institutions that serve America recognize the efficiency of Buell (van Tongeren) Collectors as a protection against fly ash dispersion.

Among the various power plants using Buell Fly Ash Collectors is a leading American educational institution, the University of Illinois at Champaign. The plant of the University has used six Buell Collectors with its stoker-fired boiler, for the elimination of fly ash, over a period of several years.

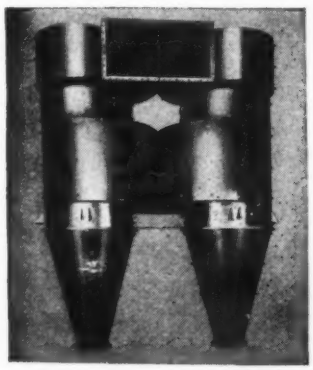


Illustration shows typical unit of a battery of six Buell Fly Ash Collectors installed with stoker fired boiler in power plant of University of Illinois.

In fact it may be said that power plants employing Buell Collectors represent a fair cross-section of American industry. They include such well known concerns as: BETHLEHEM STEEL COMPANY, STEELTON, PA., PHILADELPHIA NAVY YARD, WESTVACO CHLORINE PRODUCTS CORPORATION, CONNECTICUT LIGHT AND POWER COMPANY, JACOB RUPPERT BREWERY.

*Detailed information on Buell Collectors to meet your specific fly ash requirements will be gladly furnished upon request.*

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**CONSULT BUELL *First* IN DUST RECOVERY**
FOR CHEMICAL • ROCK PRODUCT • METALLIC • FOOD • FLUE OR ANY OTHER DUSTS

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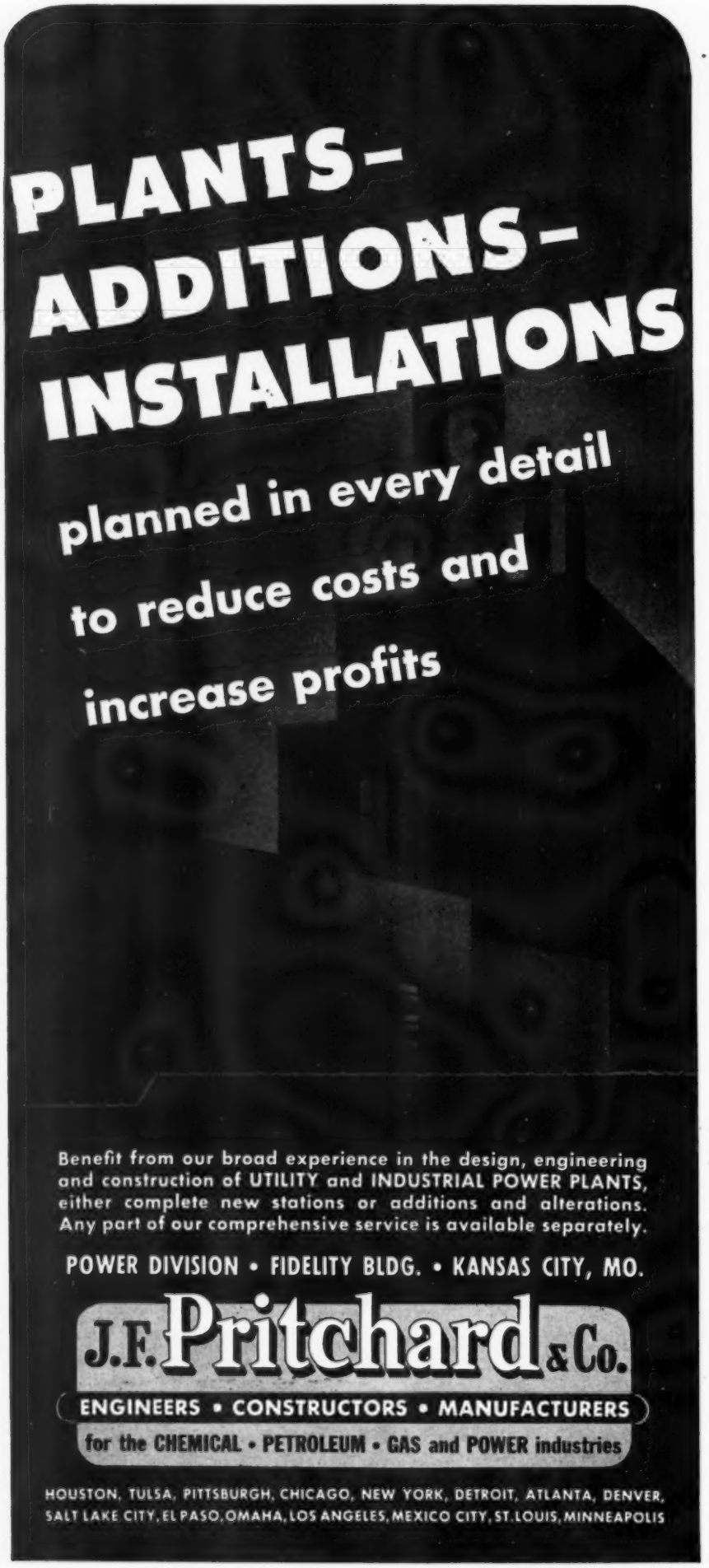
DUST RECOVERY SYSTEMS


PLANTS-
ADDITIONS-
INSTALLATIONS
planned in every detail
to reduce costs and
increase profits
Benefit from our broad experience in the design, engineering and construction of UTILITY and INDUSTRIAL POWER PLANTS, either complete new stations or additions and alterations. Any part of our comprehensive service is available separately.
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## Power News

(*Continued from page* 130)

of future requirements and trends in electric power uses by H P Seelye.

This keynote pervades individual meetings as the program broadens out into special sessions covering major topics. Central station practice with special emphasis on automatic controls, air-conditioning developments highlighting compressors and cooling towers, and feedwater treatment as it meets problems arising from high makeup combine with a 3-paper session on recent electrical developments to round out the opening day's docket.

Thursday's program gets under way with a choice of (1) purely electrical session on diesel and waterwheel generator design and power exchange in interconnected systems (2) meeting on developments in space heating with one paper devoted to radiant heating and a second by Philip Sporn on the industrial applications of the heat pump. Immediately following comes the first group of hydro-power discussions.

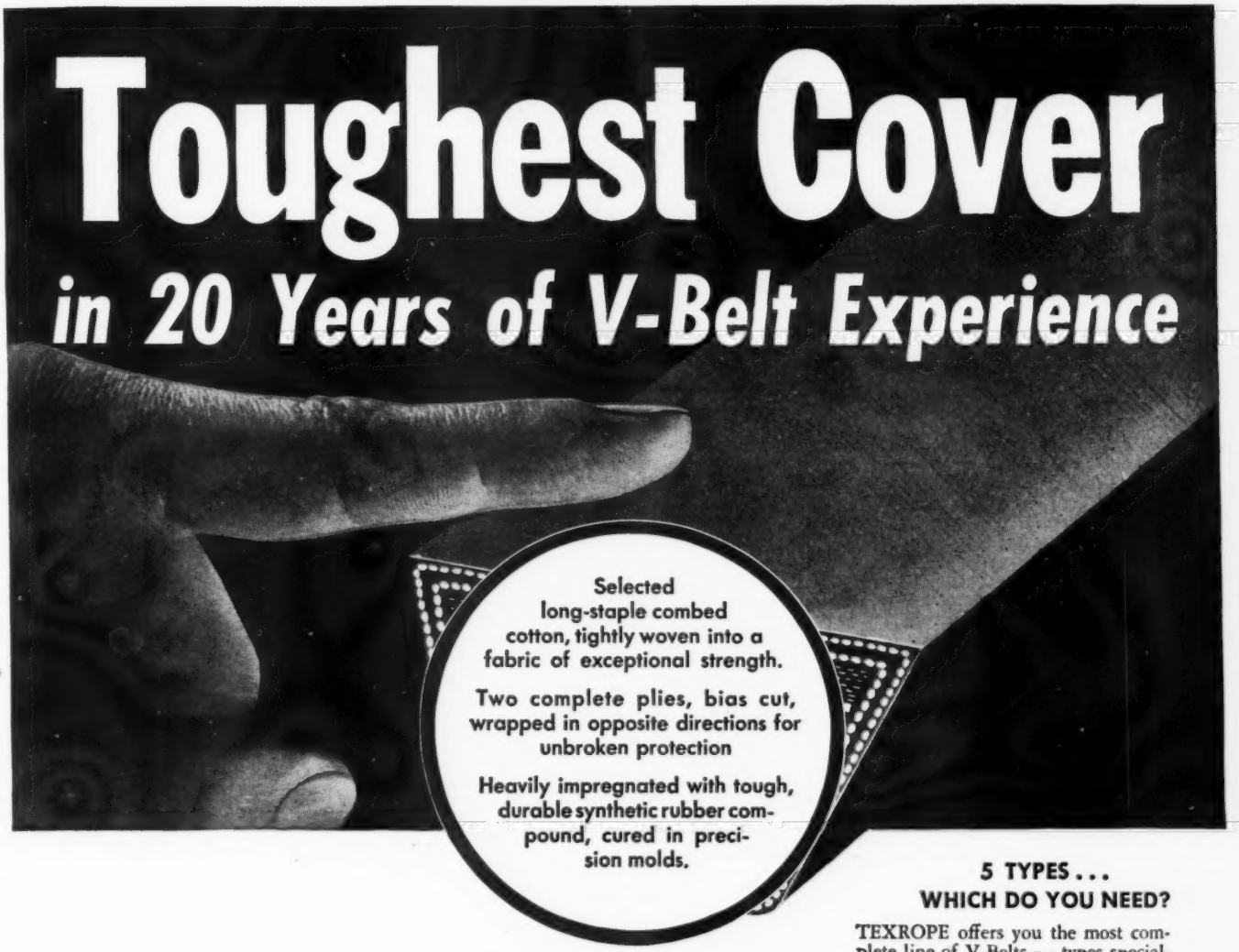
Later this same day in concurrent meetings insulation problems on power systems and diesel power provide discussion topics. The first of the gas-turbine panels meets in the afternoon. L N Rowley and B G A Skrotzki deliver a paper on the position of the gas turbine today, and J T Rettaliata discusses linear relationships in gas turbines.

Friday begins with (1) the second gas turbine session in which J R Carlson ties this subject to industry and (2) hydro power's second meeting. A general panel presents a list of speakers who speak on "Your Nation's Future, an Engineering Problem."

The afternoon of this conference's closing day treats industrial power from these aspects: (1) modernization of small plants by C M Garland (2) smoke abatement by C F Hardy and (3) extraction turbines by L E Newman. A 2-meeting division offers a session on fuels with coal handling as one item, and J I Yellott's paper on developments of the coal atomizer as another. The second general subject, industrial load supply, presents papers on the atomic bomb project, steel-mill power supplies, and special industrial-supply problems.

Luncheon held each of the three days features a principal speaker. Subjects so presented range from power-plant design problems through promotional engineering, delivered by J F Calvert at a joint luncheon with AIEE, to radar, a lecture by J A Hutcheson.

# Toughest Cover
## in 20 Years of V-Belt Experience


Selected long-staple combed cotton, tightly woven into a fabric of exceptional strength.
Two complete plies, bias cut, wrapped in opposite directions for unbroken protection
Heavily impregnated with tough, durable synthetic rubber compound, cured in precision molds.

## Allis-Chalmers Builds Longer Life Into Famous TEXROPE V-Belts

A V-Belt is no better than its COVER. And . . . TEXROPE Super-7 belts today carry the toughest, most wear-resistant cover that Allis-Chalmers has developed since they invented the Multiple V-Belt Drive! It's the result of 20 years of continuous research and improvement.

This tough, resilient sheath is unbroken and unweakened by grooves or serrations. It takes the wear, holds the belt in shape, protects the load-carrying core structure.

**Added Strength — Smoother, Cooler Running**

*50% Stronger Cords,* impregnated with friction-fighting gum rubber. *War-proved Buna-S,* better, cooler-running than natural rubber. *Perfect Balance,* every belt accurately proportioned, precision molded to run true and cool. Make Allis-Chalmers your V-Belt headquarters! ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

A 2003

**5 TYPES . . . WHICH DO YOU NEED?**

TEXROPE offers you the most complete line of V-Belts — types specially developed to meet ALL operating conditions. Pick the right TEXROPE Super-7 V-Belt — it'll give you the most in efficient power transmission.

**Heat-Resisting Super-7**
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

**Oil-Resisting Super-7**
Neoprene cover protects core against moderately oily or greasy conditions.

**Oil-Proof Super-7**
Made of Neoprene throughout. Use it when the belt must swim in oil.

**Static-Resisting Super-7**
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

**Super-7 Steel**
Twin steel cables, to pull extremely heavy loads with minimum stretch.

**GET THEM — through your Allis-Chalmers district office or dealer.**

TEXROPE Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich — and are sold exclusively by A-C.

**V-BELTS**
TEXROPE complete line — Sizes, types for every power transmission problem and condition.

# ALLIS CHALMERS
## TEXROPE V-BELT DRIVES
*ORIGINATORS OF THE MULTIPLE V-BELT DRIVE*

**SHEAVES**
"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting* Co.

# Economy of Labor

## plus FAST, SAFE OPERATION

*When you handle your Coal with a*

## SAUERMAN 1-MAN SCRAPER STORAGE SYSTEM

•

Plant executives can tell you that they have licked the coal handling problem—that they are storing and reclaiming their coal at a cost of only a few cents a ton—that with Sauerman equipment they are able to utilize ground space of any size and shape, building higher piles than otherwise possible — piling in compact layers with no segregation —no air pockets for spontaneous combustion.

Picture shows stockpile at 25,000 KW. central station where a 1 cu. yd. Sauerman Scraper stores and reclaims about 130,000 tons of coal per year. These scrapers are made in sizes to carry from ¼-ton to 8-ton loads of coal.

All this is done with a simple one-man machine. Isn't it worth while to examine the evidence? Send NOW for catalog.

**SAUERMAN BROS., Inc.**

562 S. CLINTON ST., CHICAGO 7, ILL.

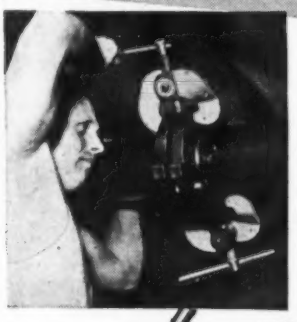


# FLANGE JACKS

## MAXIMUM PROTECTION

**to personnel and plant!**

FLANGE JACKS are vital when replacing gaskets in presence of oil or gas fumes . . . eliminates hammer blows and sparks. FLANGE JACKS are a "must" in safety engineer specifications.



**...for safe, easy and fast gasket replacement!**

**Operating with a minimum of effort — vital in tight, cramped quarters — FLANGE JACKS exert tremendous pressure smoothly and evenly. There is no shock along the pipe line, bolt holes are maintained in perfect alignment, and flange faces cannot be damaged. FLANGE JACKS eliminate long costly shut-downs.**

**TAKES A FRACTION OF THE USUAL TIME!**

Detailed information concerning this exclusive tool will be sent promptly on request. Write Dept. E. or contact your nearest distributor.

**T. G. PERSSON COMPANY**

224 GLENWOOD AVE., BLOOMFIELD, NEW JERSEY


## Floating Power Plants Still Up for Purchase

Europeans have shown so little interest in purchasing one of the 30,000-kw floating power plants which the Army has been operating in Belgium that the War Dept is about ready to bring the craft home for disposal by the Reconstruction Finance Corp. There was some speculation as to whether disclosure of plans to return the plant to this country might not bring some response from foreign purchasers. One of the two "floaters" which the Army took to Europe has been returned to this country and is now up for sale by RFC. It had been expected the other would be sold abroad.

While the boilers installed on the floating power plants are lighter than would have been chosen for land stations, the turbine-generators are standard equipment. The plants have been operated at heat rates of about 12,500 Btu per kwhr. Maintenance would run somewhat higher than on comparable-size land installations.

RFC has the firm of Morris and Van Wormer making a valuation study of *Seapower*, the unit now at Philadelphia Navy Yard, which is up for sale. Cost of the *Seapower* and *Resistance*, the latter still in Europe, totaled somewhat under $4,000,000, including cost of fitting them with prows and sterns for the ocean crossing and with equipment making them capable of 50-cycle operation. How much of this RFC would write off without argument as direct war cost is not known.

## Contract Awarded For Davis Dam Construction

Interior Secretary Harold L Ickes has authorized award of a contract for construction of Davis Dam on Colorado River below Boulder Dam to the Utah Construction Co of San Francisco. The project had just been started when it was stopped by WPB in 1942. The contract calls for expenditure of $21,462,505. Total estimated cost of the project, one of four on the Colorado, is $77,000,000.

Reservoir will have a storage capacity of 1,820,000 acre-ft and five 45,000-kw generators in its power plant, with a switchyard serving a system of transmission lines and substations which will integrate Davis power plant with those at Boulder and Parker dams for movement of energy to pumping loads of the Gila irrigation project, commercial markets of central and southern Ariz. and Imperial and Coachella Valleys of southern Calif.

According to Commissioner Michael W Straus of Bureau of Reclamation, the dam is "designed principally to generate electrical energy and to regulate the river at the international boundary . . ." It will store and re-use water released 64 miles upstream at Boulder and will release it a second time in conformity with provisions of the recently ratified water treaty with Mexico.

---

**The 1946 annual meeting** of National District Heating Association will be at The Cavalier, Virginia Beach, June 3-6.

# Avoid Leakage

1 ELIMINATE CONCEALED DEFECTS in piping connections by specifying Forged Fittings.

2 ELIMINATE FATIGUE FAILURES under vibration by specifying Forged Fittings.

3 RESIST STRAINS of expansion and contraction under extreme temperatures by specifying Forged Fittings.

4 OBTAIN MAXIMUM STRENGTH to withstand hydraulic shock pressures by specifying Forged Fittings.

## *Specify* LADISH Drop Forged Steel Fittings

The sharp, cleancut threads, accurately machined to exacting tolerances, together with the strength and endurance afforded by Ladish Controlled Quality Forged Steel Fittings, assure ultimate economy by minimizing replacement and maintenance cost.

Write for your copy of Ladish Forged Steel Fittings Catalog, Volume 2.

ARMY E NAVY

FITTINGS DIVISION

**LADISH DROP FORGE CO.**

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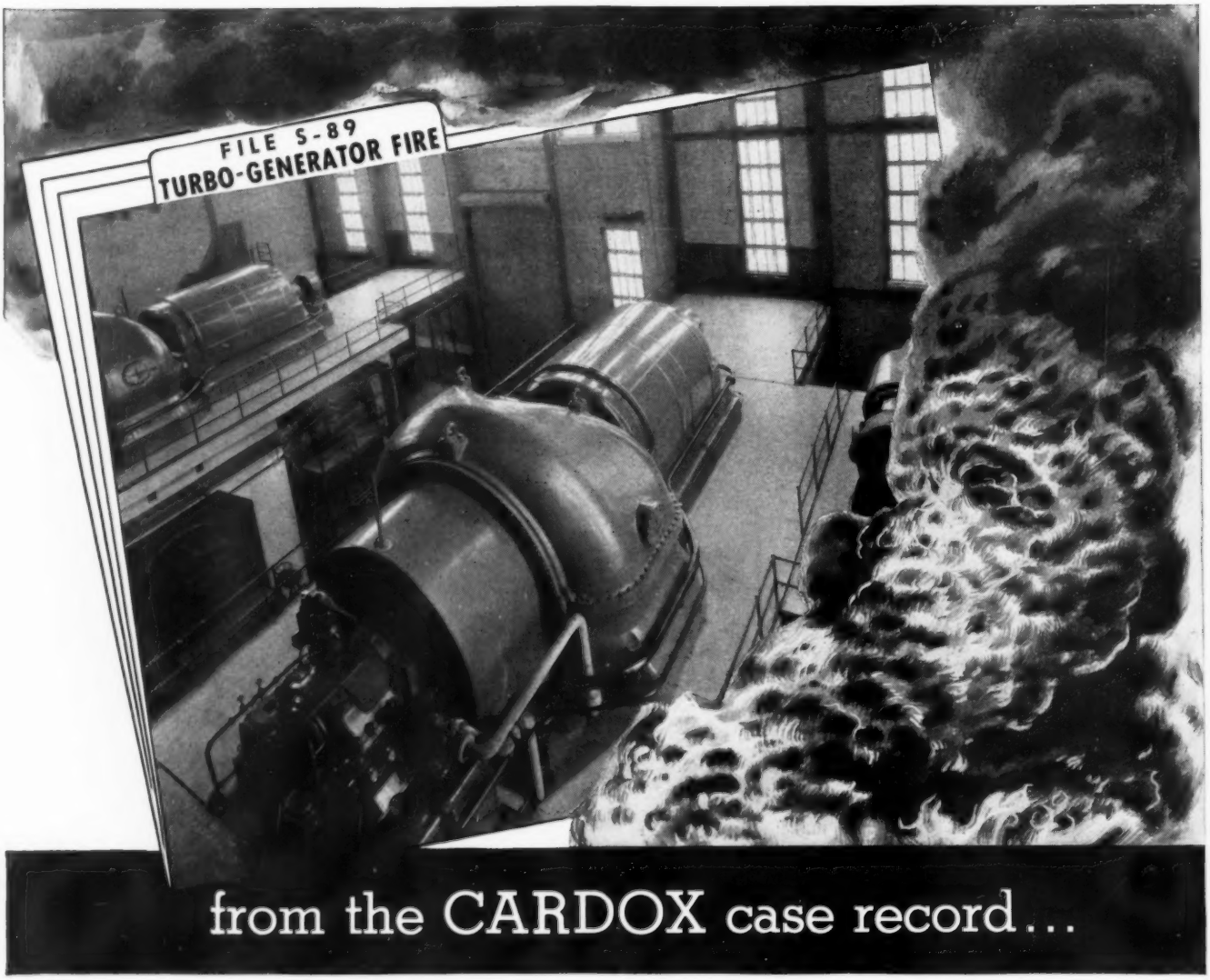


# from the CARDOX case record...

Out of actual on-the-job fire experience comes convincing evidence that Cardox Fire Extinguishing Systems have broadened the performance scope of carbon dioxide as a fire fighting medium . . . to set a new high standard of protection for many of the most severe hazards in American industry.

File No. S-89, recording a report on Cardox speedy extinguishment of a 15,000 K.W. Turbo-Generator fire, offers an interesting example of Cardox performance on one of many types of hazards most effectively protected by fast-acting, non-damaging Cardox $CO_2$.

"Turbine had been shut down for clean-up of exciter and periodical tune up. In putting generator on the line, a direct internal short and resultant fire occurred.

"The Cardox System was actuated automatically by differential relay and operated perfectly on timed discharge. While insulation on coil end loops is burned off in some areas, fire did not reach into that part of the coils in the stator slots. Furthermore, inspection shows the rotor to be entirely undamaged. Plant Fire Chief is especially well pleased by the speed of extinguishment since such a fire normally results in very severe and costly damage to the generator. In this case, only a minimum of repair time and expense will be involved."

The danger spots in your plant may not be similar to the one described here. But if they involve electrical equipment, flammable liquids or any of a multitude of hazardous operations, a Cardox System offers a new high standard of swift, efficient protection. Through the distinctive Cardox method of control and engineered application, fast-acting, non-damaging carbon dioxide is made available in *tons* for large fires . . . in *pounds* for small ones, with ample reserve for new emergencies.

An analysis of your fire hazards by Cardox Research Division and Engineering Staff puts you under no obligation. Write for Bulletin 546, explaining why and how Cardox has given carbon dioxide a scope of usefulness and fire extinguishing performance far beyond its generally recognized scope.

**CARDOX**
$CO_2$ FIRE EXTINGUISHING SYSTEMS

**CARDOX CORPORATION**
BELL BUILDING • CHICAGO 1, ILLINOIS

*District Offices in*
New York • Philadelphia • Washington
Pittsburgh • Cleveland • Detroit
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Los Angeles • San Diego

# A Candle Won't Broil a Steak

## —and neither will inadequate wiring run electrical equipment at FULL CAPACITY

# Wire ahead!

IF A MACHINE is running 1500 RPM, and it should run 1800 RPM, don't blame the operator. Chances are that *reduced voltage* is curtailing the machine's production. In fact, inadequate wiring can reduce efficiency as much as 25% to 50%!

Check up now on your *real* power needs! Don't let obsolete wiring handicap expensive production equipment. Remember that emergency alterations later may cost much more than foresighted wiring improvements today.

Talk it over with consulting or plant power engineer, electrical contractor or power salesman. They'll advise: Wire Ahead! Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company, 25 Broadway, New York 4, N. Y. Sales Offices in Principal Cities.

Look to Anaconda for wire and cable controlled from copper ore to finished product by Anaconda basic research and engineering. Every Anaconda product is a lasting investment . . .

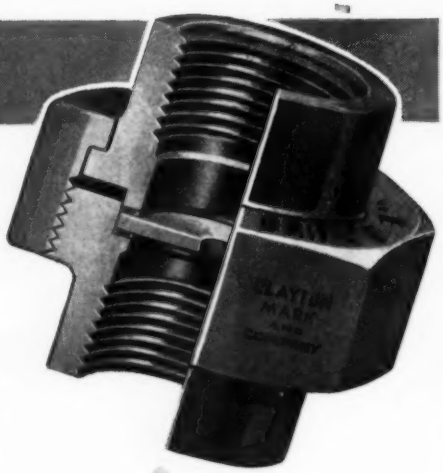
*Check your wiring plans before they check you!*

DON'T BE PENNY-WISE AND POWER-FOOLISH

ANACONDA WIRE & CABLE COMPANY

# ORIFICE FORGED STEEL UNIONS

## Orifice



**A SIMPLE, EASY-TO-HANDLE, MODERATELY PRICED, ORIFICE UNION.**

Ideal for flow control of Steam, Oil, Ammonia, Water, Gas and Air. Also for metering and measuring. 600 lbs. S. W. P. or 2000 lbs. C. W. P. The ORIFICE plate is furnished in cold rolled 18-8 stainless steel. ORIFICE plate and gaskets are set in a groove of solid steel to safeguard against blowing of gaskets and resultant trouble. The ORIFICE union has extra heavy ends and nut with the nut threads permanently lubricated.

**SIZES ¼" TO 3"**

## Petro

**SIZES ⅛" TO 3"**

**AMERICA'S MOST UNIVERSALLY USED UNION**

PETRO unions have integral steel to steel seats. Made to A. A. R. design. 600 lbs. S. W. P.-2000 lbs. C. W. P. Extra heavy ends and nut with nut threads that are permanently lubricated. The seats are machined and cold rolled.

**A PARTIAL LIST OF PROVEN SERVICES**

Pressures from a vacuum to 3000 lbs.: Temperatures from 100° below zero F. to 1000° above zero F.: On Steam, Gas, Air, Oil, Gasoline, Ammonia, Chemicals, and any service in which Steel or Wrought Iron Pipe is Used.

**ORIGINATORS AND PIONEERS OF FORGED STEEL UNIONS SINCE 1912**

**WRITE FOR PAMPHLET AM-67 • ORDER BY TRADE NAME FROM YOUR JOBBER**

**CLAYTON MARK & COMPANY**

1900 DEMPSTER STREET • EVANSTON, ILLINOIS


## AWS Selects Papers For Welding Awards

To stimulate undergraduate interest in welding, funds have been donated by A F Davis, of the Lincoln Electric Co, for the A F Davis Undergraduate Welding Award, which will consist of four cash prizes totaling $700 to be presented annually to authors and publications for the best and second best articles on welding published in undergraduate magazines or papers during the preceding year.

Any undergraduate of a college, university or institute of technology in the United States or Canada is eligible, but the paper must be published in an undergraduate publication. Judges selected by the educational committee of the American Welding Society will select the winning paper in July of each year on the basis of its originality and thoroughness with which the subject is covered. Six copies of the publication must be forwarded to the American Welding Society, 33 W 39th St, New York, N. Y., marked to the attention of the chairman of educational committee.

Presentation of the first A F Davis Undergraduate Welding Awards for papers published between now and July 1, 1946, will be made at the next annual meeting in Oct 1946.

## Most Powerful X-Rays Ferret Steel Secrets

An industrial application for the most recent electronic device, the 20,000,000-v betatron has been disclosed by the University of Illinois and Allis-Chalmers Mfg Co. in a joint release.

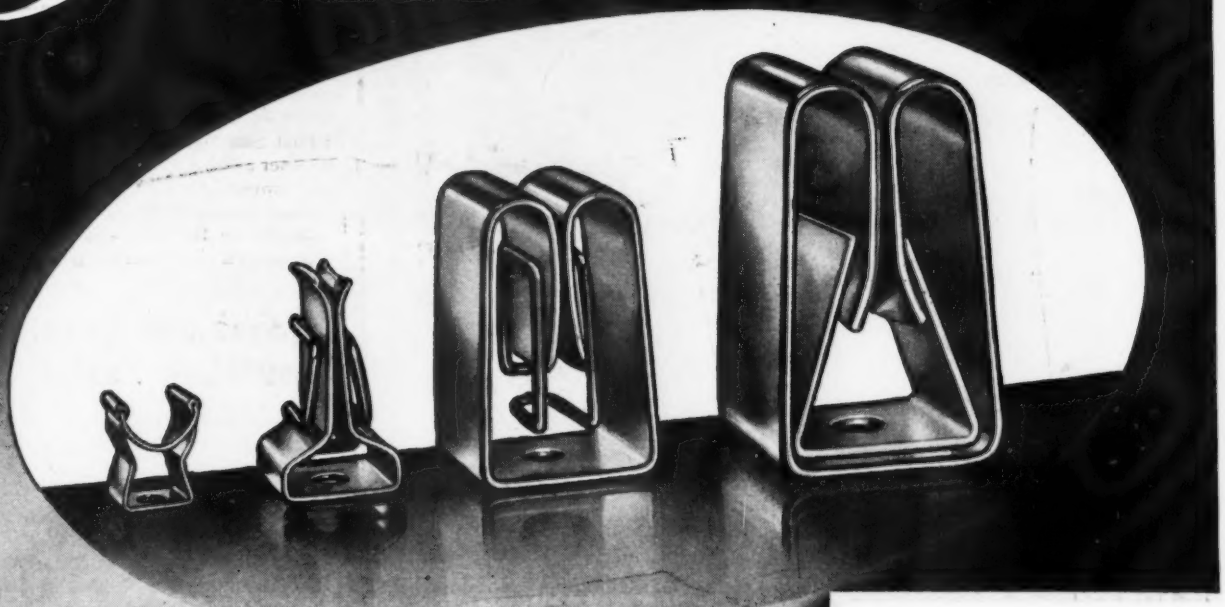
For over a year in a government arsenal a betatron has generated X-rays more powerful than any ever used in radiography. These X-rays depict interior steel structure as deep as 15 in., thus making possible thorough inspections of battleship steels. Betatron operates from pushbutton controls with automatic timing for photographic exposures so that an ordinary X-ray technician skill is all that is required.

Dr G D Adams, physicist at the University of Illinois, credited Dr D W Kerst, another physicist at the school, with basic laboratory development of the machine. Kerst overcame the obstacles and demonstrated the practicality of generating, accelerating and guiding a stream of electrons traveling at about the speed of light in a vacuum. This beam of electrons strikes a metal object and produces high intensity X-rays.

---

**Reconstruction Finance Corp** announced transfer of all its surplus property activities to War Assets Corp, a subsidiary of RFC. War Assets Corp has been designated by the surplus property administrator as the disposal agency for all government-owned surplus consumer goods and producers and capital goods. Lt Gen E B Gregory, Army Quartermaster General, at request of President Truman, has taken office as chairman of board of directors of the new corp, which will be responsible for sales of all such property declared surplus by the Army, Navy and other government agencies.

# Positive Pressure FUSE CLIPS

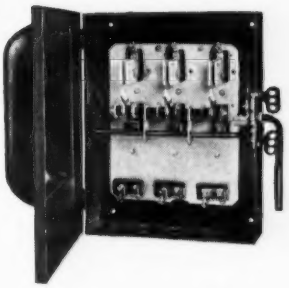


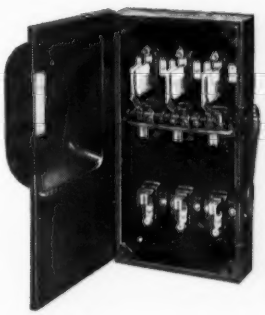
## . . . an exclusive feature of all Square D Safety Switches

What do these fuse clips add to overall safety switch performance? Plenty!

- They reduce heating at contact points by 60%, compared with conventional type clips.
- Copper instead of bronze, they afford substantially more conductivity.
- Lower contact resistance because of higher contact pressure.
- Design permits easy insertion and removal of fuses, notwithstanding the higher contact pressure.
- The Positive Pressure is automatic. It requires no bolts or clamps. It is immune to the loosening effect of vibration, wear or thread stripping.

This is one of many basic features which have placed Square D safety switches in the number one preference spot.

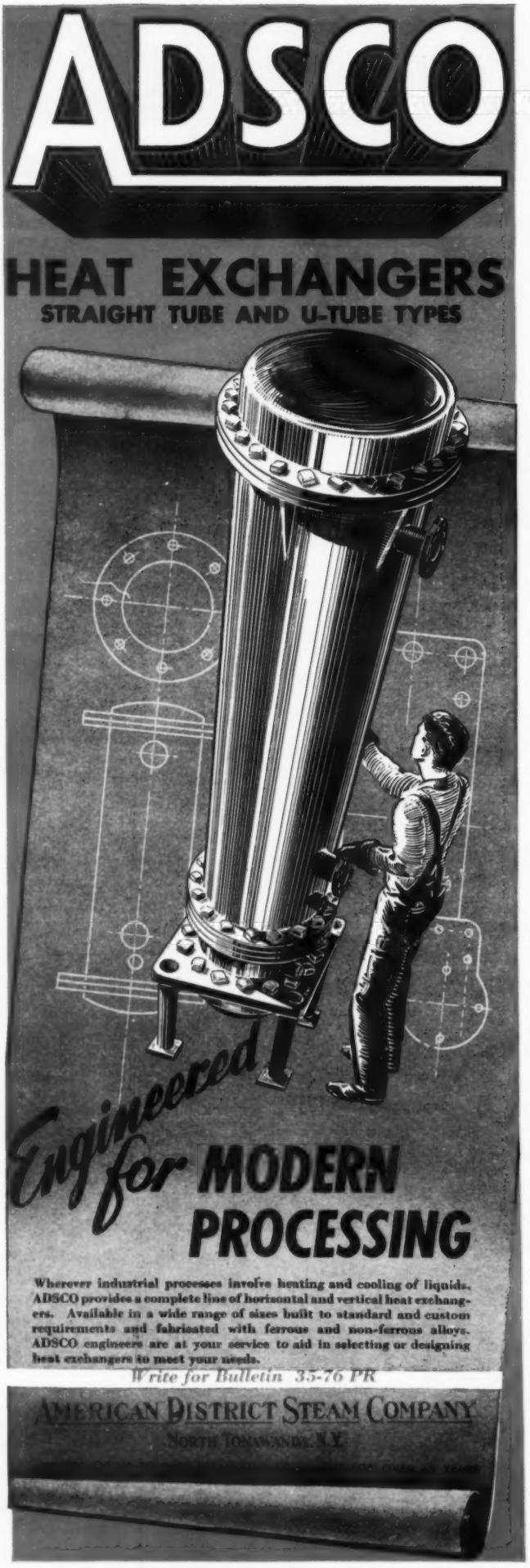




*Write for BULLETIN 500 which describes Square D's complete safety switch line and all its features. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.*

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES


ADSCO
HEAT EXCHANGERS
STRAIGHT TUBE AND U-TUBE TYPES
Engineered for MODERN PROCESSING
Wherever industrial processes involve heating and cooling of liquids, ADSCO provides a complete line of horizontal and vertical heat exchangers. Available in a wide range of sizes built to standard and custom requirements and fabricated with ferrous and non-ferrous alloys. ADSCO engineers are at your service to aid in selecting or designing heat exchangers to meet your needs.
Write for Bulletin 35-76 PR
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.

## Merchant Marine's Boiler Study on Practical Basis

Hagan Corp, Hall Laboratories and their marine chemists, Bull & Roberts, have been closely associated with Merchant Marine training courses on boiler-water and combustion control. Many representatives of these organizations have volunteered their assistance at various school centers and for different levels of instruction in the fields they represent.

Many boiler installations at the various schools operate with Hagan combustion controls, with these as well as others using Hall feedwater-treatment methods and Bull & Roberts test equipment. With these practical laboratories at hand much of the instruction could be and was readily demonstrated. For instance, the U. S. Merchant Marine Cadet School, San Mateo, Calif., was given a Foster Wheeler and a Babcock & Wilcox boiler from a destroyer. A complete Hagan combustion control was offered and accepted by the government so that an actual ship installation served as a classroom for boiler studies.

## Proves and Locates Insulation Faults

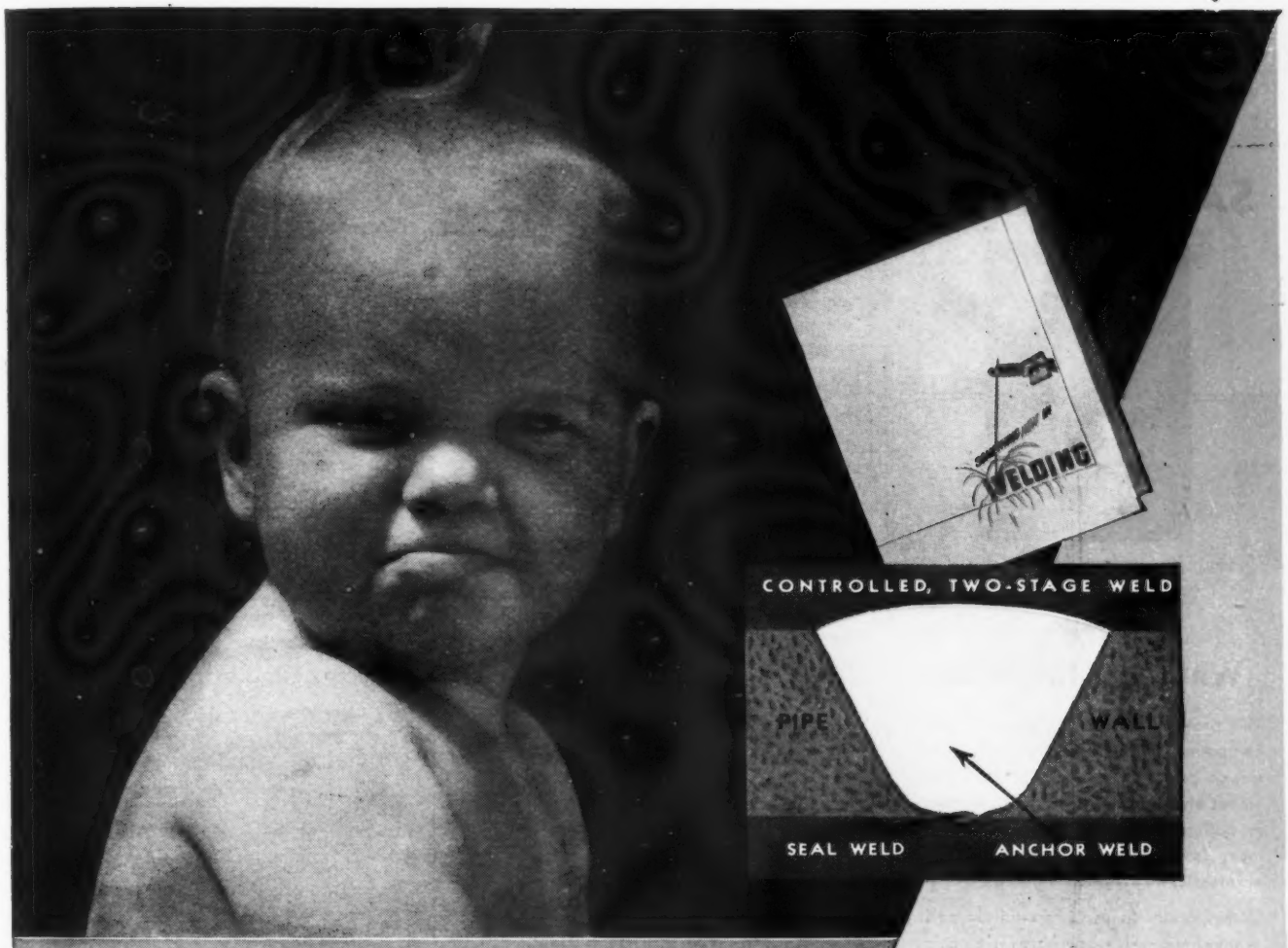
Westinghouse Electric Corp has developed a set for determining weak spots in insulation and then locating these points. One major trouble in making high-voltage tests has been the delay in transferring connections from a source of high-voltage excitation to a relatively low-voltage high-current source to burn the insulation and locate the fault.

Often this fault-burning transformer's voltage output was too low to reestablish an arc. This new set immediately switches the low-voltage source across the fault once the high-voltage discovers it. A further guarantee exists in the form of a high-frequency arc-stabilizing current to maintain an arc through the current zero of 60-cycle power. A 2-position toggle allows removal of this automatic switching feature if so desired. This provision enables use of the high-voltage test circuit without any changeover.

---

**American Standards Association** announces completion of a new standard on method of compiling industrial injury rates. This code provides a practical basis for recording and measuring industrial injury experience. So that the resulting records may have a uniform experience basis covering the entire country, the provisions are independent of state and federal requirements for reporting injuries for workmen's compensation and of rulings as to disability by workmen's compensation agencies. *Method of Compiling Industrial Injury Rates* may be obtained from American Standards Association, 70 E 45th St, New York 17, N. Y., for 25¢ a copy.

**When the International Lighting Exposition** convenes in Chicago's Stevens Hotel next April 26, one of the purposes served will be that of focusing the nation's attention on the need for a fuller and more enlightened use of lighting in industry, business, stores, farms, homes, schools, etc.




# INSIDE OF BUTT WELDED JOINTS*
# SMOOTH AS A BABY'S SKIN

If you ran your hand over the *inside* of a Westport Joint, you'd find it to be *smoother than the outside* of the neatest job of fusion, butt welded pipe you ever saw. This is because icicles of metal inside butt welded joints are eliminated, without resorting to the use of backing rings, which are perhaps the lesser of two evils. Westport Joints are made by a patented method of Controlled, Two-Stage Welding assuring "penetration without protrusion". They are especially advantageous in heavy wall piping for high pressure-temperature conditions. Our bulletin "Something New in Welding" tells the complete story. Write for it today. And remember, while our shop pre-fabricated piping can be made with any type of joint, we believe you'll prefer and specify the Westport, after you read our bulletin.

**WESTPORT JOINT**

*MADE WITHOUT BACKING RINGS BY THE MITCHELL-WESTPORT METHOD

(PATENTED)

**W. K. MITCHELL & CO., INC.**
2944 ELLSWORTH STREET
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# MITCHELL

PIPING FABRICATORS AND CONTRACTORS

*The Solution For*
*Solving the Problem of*
*Boiler Scale and Corrosion*
↓

**SAND-BANUM**

*"The Entirely Different Boiler and Engine Treatment*

**Here's Whys for the Wise**

This proved product is a pure colloidal compound, guaranteed absolutely harmless to personnel and equipment. It removes and prevents scale and corrosion in boilers and tubes while the equipment is operating; its action entirely automatic.

Comes ready to use immediately as is —anywhere and everywhere—simplicity itself. Requires no special equipment, or titrating—has no carrying agent; just 100% active ingredients. Retains full efficiency regardless of age, climate, water or operating conditions; eliminates need of water analyses. Comes in 16-oz. cans taking up a minimum of space.

Its consistent use results in operating efficiency, lessens repair bills, reduces fuel cost, eliminates mechanical scrapings and lessons time out of service; fewer and shorter shut-downs.

Complete data will be gladly sent on request. You can rely on Sand-Banum's record of service for more than nineteen years. It has been consistently used by representative companies here and abroad over a long span of years.

***Don't Delay—Write Today***

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Stocks carried by
WESTERN SAND-BANUM COMPANY
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and at other convenient points including leading supply houses
*Export Representatives*
PETROLEUM MACHINERY CORP.
30 Rockefeller Plaza New York 20, N. Y.

## Reactors Make AC Hoists Possible

Elimination of a dc-distribution system in plants may well be achieved if developments by Westinghouse continue acceptable. Last stronghold of constant-voltage dc motors has been overhead cranes with their needs for wide speed and dynamic braking. New system unbalances voltages of an ac system by using a reactor in one primary line so that motor operates at increased slip for reduced hoisting and better-controlled lowering speeds. Introduction of a small amount of reactance to the circuit allows more normal motor operation. An increase of reactance in one primary line produces an approach to single-phase operation. With a continuously variable reactor and inherent variations in impedance with speed, great flexibility becomes possible with a load or an empty hook.

---

**Resistance Welder Manufacturers' Association** will award cash prizes in 1946 for outstanding papers on resistance welding subjects. The judges will be appointed by the American Welding Society and awards will be made at the 1946 fall meeting of the society. The prizes are as follows: (1) $750 for the best paper from an industrial source, consulting engineer, private or government laboratory, etc (2) $500 for the second best paper in the above classification (3) $250 for the third best paper (4) $300 for the paper from a university source, such as instructor, student or research fellow (5) $200 for the second best paper from a university source. For further information, write to Resistance Welder Manufacturers' Association, 850 Euclid Ave, Cleveland 14, O. Contest papers should be sent to American Welding Society, 33 W 39th St, New York 18, N. Y.

**Public Service Electric & Gas Co** plans to construct a generating station on the Arthur Kill at Sewaren, Woodbridge township. The initial step includes installation of two 100,000-kw high-pressure high-efficiency generating units, with the necessary auxiliary apparatus, buildings, docks, coal-storage facilities, and electrical switching and transformer equipment and connecting transmission lines, estimated to cost $23,000,000. Engineering work is under way and it is expected that construction work will start in the fall of this year. The new station will be available in the fall of 1948.

**American Chemical Society** will award fellowships, aggregating $210,000, in 1946 and 1947 to aid in training of chemists and chemical engineers. Predoctoral students whose work was interrupted by the war will receive $100,000. Grants of $110,000 will be made to holders of the doctor's degree who desire to devote one or two years to research and teaching.

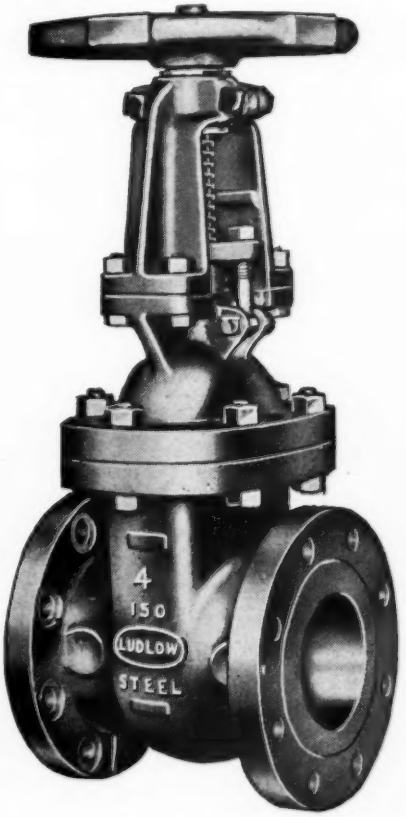
**Production for Profit** will be theme of Chicago Production Show to be staged March 20-22 at the Stevens Hotel by Chicago Technical Societies Council, representing 46 scientific, engineering and technological societies with a combined membership of more than 17,000.

**M·ODERN**

**FROM HANDWHEEL TO FLANGE**

No point of good engineering practice was overlooked in designing the Ludlow Cast Steel Wedge Gate Valve line. The sturdy lugged-rim handwheel which provides a slip-proof grip on the cool rim and the heavy split yoke to take the thrust, with the handy cast lugs for use as a follower shelf during repacking, are but two exterior examples of the superiority of this Ludlow design.

Write for complete Ludlow Valve Catalogs.




**Ludlow Cast Steel Wedge Gate Valve. Now made in sizes 4" to 12", 150 lb. series only.**

The LUDLOW VALVE MFG·CO·INC SINCE 1866 TROY·N·Y·

# EVERY CC GETS AN OK

## It's compact, but it handles *full flow*

## It's positive, but it never interrupts production

*Every drop of the fluid you want cleaned gets cleaned by the Cuno "filter-fine" strainer.*

No larger than the usual partial-flow type, it handles full flow without the necessity of an expensive, space-consuming duplex installation. Every drop of the fluid is inspected by the permanent, all-metal filter element — built-in or externally mounted.

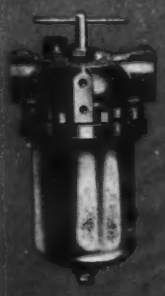
Providing absolute certainty of removing all particles larger than specified (down to .0025"), it is also continuously-cleanable *while in operation.* No production delay due to a clogged filter — or for cleaning the filter.

The Cuno catalog in SWEET'S tells which Cuno model is best for your requirements — or send for complete catalog (use coupon). Cuno's engineering staff will also help you on special conditions.

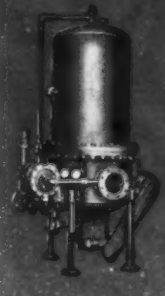
KEEP FLOW ON "GO" WITH

CUNO

ENGINEERED FILTRATION



AUTO-KLEAN *disc-type.* For all fluids except those containing highly abrasive solids. Viscosities from 30 to 30,000 Saybolt seconds. Minimum pressure drop. Continuously cleanable by turning a handle (manually or automatically). Occupies no more space than usual partial-flow type. Sizes from 1¼" diam. x ¾" cartridges to massive motor-driven models. Available with or without sump for built-in or external installations.



FLO-KLEAN *edge-strainer.* For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. May be designed to remove particles .0025" or larger. Continuously cleaned by backwash system. Low pressure drop — fluid moves in straight line, encountering only momentary restriction. All parts made of metal — constructions to meet varying corrosive and erosive conditions.

**FOR A COMPLETE CUNO CATALOG, SEND COUPON**

**CUNO ENGINEERING CORPORATION**
**226 South Vine Street, Meriden, Conn.**

Please send me a free copy of your catalog. I am especially interested in the services checked.

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| ☐Acids | ☐Gases | ☐Paint |
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| ☐Alkali | ☐Grease | ☐Quenching Oil |
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| ☐Cleaning Solutions | ☐Japan | |
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| ☐Dip Tank Systems | ☐Machine Tool Hydraulic Oil | ☐Test Stand Lubricating Oil |
| ☐Enamel | | |
| ☐Engine Fuel | ☐Machine Tool Lubricating Oil | ☐Varnish |
| ☐Engine Lubricating Oil | | ☐Washing Compounds |
| ☐Fuel Oil | ☐Nitrocellulose Solutions | ☐Water |
| ☐Fuel Tar | ☐Oils | ☐Wax |

Others .....

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*Title*.....

*Before you buy any *Breechings . . . Get a*
**CONNERY CONSTRUCTION** *estimate!*

★ Connery Construction is electrically welded; Accordion-type Expansion Stiffener makes it buckle and warp proof, air and moisture tight. Let us tell you more about it for your jobs.

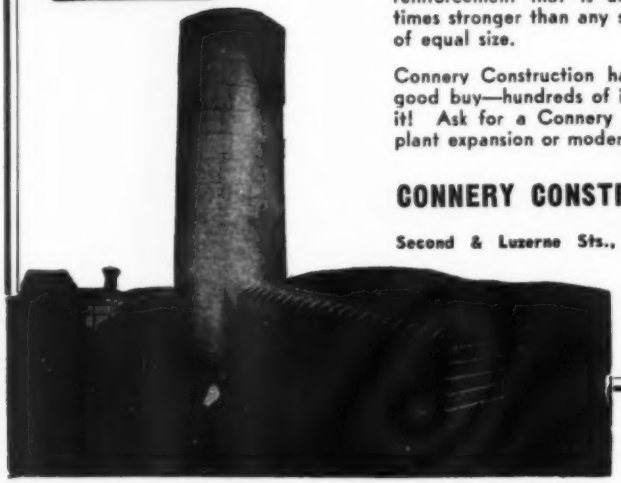
Much of the ability of Connery Construction to deliver long, air-tight, moisture-tight service comes from the use of Connery's "V" type stiffeners, cold pressed into the sheet metal from which the breechings or ducts are formed.

This improved Connery Expansion-Stiffened construction, plus electrically welded joints, eliminates buckling and warping—provides reinforcement that is uniform and many times stronger than any structural member of equal size.

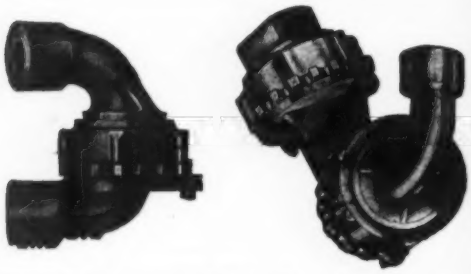
Connery Construction has always been a good buy—hundreds of installations prove it! Ask for a Connery bid on your new plant expansion or modernization job.

**CONNERY CONSTRUCTION CO.**

Second & Luzerne Sts., Philadelphia, Pa.



**THE FLEXIBILITY OF HOSE with the SAFETY and RIGIDITY of PIPE . .**
**FLEXO JOINTS**



Flexo Joints are sturdy, simple and accurate in their construction—they feed pressures, vapors and fluids,—entirely unrestricted—to moving parts. Fully enclosed from grit and dirt.

Trouble-free operation—no springs, no small loose parts and no ground surfaces to wear. Full 360° range of movement. Handles all pressures from gravity up.

Four styles for pipe diameters ¼" to 3".

Massive steam platens on these presses are connected with Flexo Joints.

*Write for specifications and prices on Flexo Joints.*

**FLEXO SUPPLY COMPANY, Inc.**

4224 OLIVE STREET — ST. LOUIS, (18) MO.

*In Canada:* S. A. ARMSTRONG LTD., 115 Dupont St., Toronto (5), Ont.

## Ontario Starts Postwar Expansion

Marking the start of Hydro-Electric Power Commission of Ontario's $200,000,000 program of postwar expansion, work is now under way on three projects which, over the next four years, will make available half a million additional hp at a cost of $65,000,000 to meet demands for hydro power in southern Ontario. The agreement reached between Ontario and Quebec on development of power sites on the Ottawa River paved the way for a start being made on the 400,000-hp plant at Des Joachims, which is 200 miles north of Toronto and 100 miles northwest of Ottawa. This development will cost about $50,000,000 and will supply power by 1949. Plans for Des Joachims generating plant include construction of a concrete dam, 2500 ft long and 135 ft high, along with a control dam to regulate water flow.

Hydro-Electric Power Commission of Ontario has also started work on a 54,000-hp development at Stewartville, on the Madawaska River, about 40 miles from Ottawa and near Arnprior. This development will cost about $9,000,000 and will be placed in service by the fall of 1947.

Work is now well under way on the $7,000,000 extension of the DeCew Falls plant to provide an additional 70,000 hp. Located near St. Catherines, this development was placed in service in Oct 1943 and the new 250-ton generating unit now being installed will be supplying power by summer of 1947.

---

**Edmonton, Alberta,** municipal power plant established a new record recently when feeder lines carried a peak load of 32,100 kwhr. Only 29,000 kwhr were generated at the city power plant, the remaining 3100 coming from Calgary Power Co. Under a special agreement, company handles any load over 29,000 kwhr, officials said.

**Installation** of a new 7500-kw steam-turbine alternator will be undertaken at the Prince Albert power plant, according to W J Murphy, district superintendent of Canadian Utilities Ltd. Delivery has been promised within the next 21 months but indications are that delivery may be within the next 18 months. This is part of the $500,000 program of expansion by the company in Prince Albert district. Work has begun on the installation of a new steam boiler with a capacity of 100,000 lb of steam per hr. Preliminary construction on the foundation has been completed. It is expected the boiler will be ready for service next spring. Installation of the new boiler and generator will more than double present steam and generating capacity of the local power plant. A new water intake at the river is one of the other improvements planned.

**Annual review** of hydroelectric progress in Canada, as released by Honorable J A Glen, minister of mines and resources, indicates that ending of the war brought about a cessation of new power development and some curtailment in generation of electric energy in certain regions, while in others, where war restrictions and material shortages have delayed new undertakings, construction was

# FUEL FLEXIBILITY

## THE MODERN SAFETY FACTOR

Modern design of steam generating equipment discards the old, tight, restricted fuel furnaces for new flexibility to burn the range of fuels economically available and to give the highest dollar efficiency for the life of the plant.

## ONE DIMENSION—KEY TO FLEXIBILITY

One boiler manufacturer has standardized a popular type of pulverized-coal-fired unit, so that for a given steam-generating capacity at a specific pressure and steam temperature a definite arrangement of boiler and furnace will be suggested. Different grades of coal will, however, require varying amounts of heat-absorbing surface in the furnace to avoid slagging. Flexibility in this respect is provided by varying the furnace size *merely by changing one dimension, the height of the furnace* as shown by the shaded portion of the drawing.

## THE DESIGN SPECIFICATION

Should include the critical characteristics of the range of coals which sound fuel planning forecasts as competitively available. Limited reserves of high quality fuels are seldom the best dollar value for generating steam and usually the poorest coals obtainable will not give the lowest steam cost. A proper fuel specification compromises between these limits to provide justifiable Fuel Flexibility.

## FUEL FLEXIBILITY—*economically sound*

1. **Increased investment is normally less than 10% and can probably be amortized in fuel savings in less than one year.**
2. **Freedom in fuel purchasing permits the selection of the best current fuel value.**
3. **Changing market conditions demand fuel flexibility in furnace design.**
4. **Competitive over-all steam cost assured for the economic life of the plant.**

**FAIRMONT COAL—** The Fuel Investigation reveals that in most markets Fairmont Coal will continue to be an excellent value in the foreseeable future. Many Utilities and Industrials are using the characteristics of Fairmont Coal in their Fuel Design Specifications in order to insure proper Fuel Flexibility and low-cost steam for their new plants.

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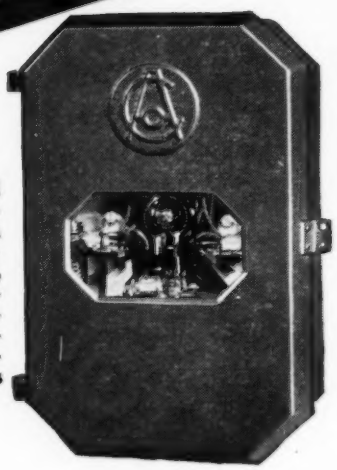
With AUTOMATIC TANKTROL CONTROL CO.



**For controlling remote and nearby elevated tanks by pressure, TANKTROLS are unsurpassed. Handles up to 3 or 4 pumps or alarm circuits. The TANKTROL exclusive two-bellows construction assures accuracy of 1% and full sensitivity over unusually wide operation range. Settings are permanently accurate. Automatic surge and backspin protection. Bulletin T-11 gives complete information—write for it. State requirements and engineering data will be furnished.**

## NO WATERLOGGING OR AIR-BINDING In Hydro-Pneumatic (Pressure) Tanks with DUOTROL

**The DUOTROL maintains high water level at a fixed point and correctly balances air pressure at that point after each pumping operation. It provides a maximum volume of water with a minimum of pump operation, saving power and reducing wear. Easy to install, stable adjustments. Ask for Bulletin D-6.**

**AUTOMATIC CONTROLS** are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

**"AUTOMATIC"** also makes float operated controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROL Company

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commenced or plans were being made for a number of projects. Only new installation during the year was one of 19,000 hp. This addition, together with adjustments from a re-analysis of developed water power in Ontario, established the total water power installation in Canada at 10,283,610 hp. Developments under construction or in active prospect in various parts of the Dominion should add substantially to this total during the next few years.

**British Columbia** Power Commission will proceed with installation of 10 to 15 modern diesel power plants within the next year. S R Weston, chairman, told members of the British Columbia Federation of Agriculture at the annual meeting in Vancouver recently that "the power commission believes that electricity can be provided to every established community in the province and service will be improved for 15,000 consumers and extended to 10,000 more within the next few years at an economical rate."

**Powell River Co** is undertaking extensive development of its plant at Powell River, British Columbia, and as an integral part of this development, the company is also increasing the capacity of its power plant at Lois River. This plant at present comprises an 18,000-kva generator and the company has now placed an order with the Canadian General Electric for one 18,000-kva 14,400-kw 333-rpm 6600-v vertical water-wheel-driven generator. Delivery will take about 18 months. It will be driven by a 25,000-hp vertical-plate steel-casing turbine with covering equipment and all accessories and draft tubes, foundations for which are already installed, as is the Johnson valve.

**In a steam turbine** the limit to volume of steam flow, and hence to economical capacity, is set by length and diameter of blades in the last row. As blades get longer, centrifugal forces tending to pull them out by their roots become enormous. Also the velocities of blade tips at high turbine speeds become very large—which places emphasis on the best airfoiling. Heretofore, the longest blade for the 3600-rpm turbines has been 20 in. New blades, designed by Westinghouse engineers and soon to undergo tests, are 23 in. long. At 3600 rpm this will mean a blade-tip velocity of 1520 fps. They will make possible steam turbines that can deliver 40,000 kw from a single-cylinder 3600-rpm condensing unit, or 80,000 kw from a tandem 3600-rpm condensing unit. These outputs compare with 30,000 kw and 65,000 kw of the present largest 3600-rpm machines.

**Daylight fluorescent lamps** that provide a new and warmer-appearing daylight color, known as *"4500-deg white"* soon will be in production at Westinghouse Lamp Div. First units available will be 40- and 100-watt sizes with a somewhat greater light output than that of the company's daylight lamps.

New color, *"4500-deg white"*, its color temperature measurement on the Kelvin scale, results from a new formula for mixing and making phosphor crystals employed in daylight and white lamps. Eugene W Beggs, commercial engineer, places this color as about midway between company's present standard white fluorescent and daylight lamps.

## In Gardening It's

# A GREEN THUMB

You've heard of the chap with a "green thumb." Everything he plants flourishes. Of course, what he really has is an unusual combination of knowledge, experience, and great enthusiasm for what he's doing.

Call it "green thumb" . . . call it knowledge . . . call it "feeling" for the job . . . it's a quality that every Stephens-Adamson engineer brings to Material Handling problems.

It comes to him from long association with a group of progressive conveyor engineers . . . with a company that for 45 years has led the field with new units and new methods.

This "feeling" for the job is supplemented by a complete line of conveyors and accessories from which S-A engineers can make unrestricted choice—the right equipment . . . to convey the right volume . . . to the right place . . . at the lowest cost per ton over the long term.

If you want the man with the "green thumb" in the bulk material handling field, talk to an S-A engineer.

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**To save time** in carrying out the objectives of the synthetic liquid fuels research and development program, Bureau of Mines has taken steps to bring to this country several thousand tons of equipment and supplies from captured German and Japanese synthetic-fuel plants and laboratories. Navy Dept has volunteered to aid the bureau in obtaining hydrogenation and oil-refining pilot-plant units, which were found intact at a Japanese naval installation, and requests have been submitted to War and Commerce Departments for similar assistance in obtaining German equipment for test purposes. Most of Germany's synthetic-fuel plants are in the British and Russian zones of occupation, but equipment desired also is available in those areas occupied by American forces.

**A contract** providing U. S. technical assistance for China in its Yangtze River development program but requiring no financial commitment by this country has been signed by the Chinese government and the Bureau of Reclamation. Interior Secretary Harold L Ickes announced that the bureau will collect a $500,000 fee for designs and specifications of Yangtze engineering projects, perhaps including the Yangtze Gorge dam. This dam, larger than Grand Coulee, would be planned for an ultimate power capacity of more than 10,000,000 kw. Near Ichang, it would back up a lake more than 250 miles long. Other dams and wide-spread irrigation facilities also are in the list of possible projects. Designing will be done in Reclamation's Denver office under direction of J L Savage.

**National Electrical Manufacturers Association** issued Publication No. 45-105, entitled *Electric Arc-Welding Machine and Electrode Standards,* covering classifications, standard diameters and package weights. The new standard for color markings for electrode identification is published as a separate standard, Publication No. 45-108. Publication No. 45-105 may be obtained at 75¢ per copy and No. 45-108 at 10¢ per copy from the Association, 155 E 44th St, New York, N. Y.

**Rogers Diesel and Aircraft Corp** announced at a dinner meeting that it had assumed manufacturing and selling rights to systems of air conditioning and air sterilization developed by Research Corp.

**Western Thermal Equipment Co** moved to larger quarters at 1701 W Slauson Ave, Los Angeles 44, Calif. The new location provides additional space to consolidate office, factory, warehouse and shipping facilities in one location and facilitate further expansion.

**New building** of Reliance Electric & Engrg Co, located alongside the main plant, will inclose an additional 48,000 sq ft. It will represent, with its machinery, equipment and moving, an outlay of about $350,000.

**Rust Engineering Co** was awarded about $30,000,000 in contracts for design and construction of industrial plants and facilities in the past year.

**Brown Instrument Co** plans to complete this year installation of $500,000 of new manufacturing, processing and development equipment started in 1945.

**NCC**

**SLUDGE SOLVENT**

***has ended sludge troubles for factories, railroads and ship lines***

Sludge follows oil like mud follows rain—regardless of the quality of the oil.

The harmful effects of sludge start in the tank, go through the feed lines and burner, right up into production —particularly if temperature or atmosphere control are important.

Frequent shut-downs to clean sludge-fouled parts are only the beginning of sludge troubles. Neglected, sludge accumulates to the point where parts may even have to be replaced.

Ridding yourself of sludge is easy and inexpensive. To your next load of fuel, just add NCC SLUDGE SOLVENT, the tested, scientifically prepared fuel oil conditioner.

NCC dissipates water and other impurities. NCC liquefies sludge already formed; cleans and keeps clean dirty tanks, clogged nozzles, clogged feed lines, dirty strainers, carbonized pre-heater coils, dirty burner tips, etc.

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## APPOINTMENTS

**Sun Oil Co** appoints Frank R Markley general sales manager. He will serve as assistant to Samuel B Eckert, vice-president in charge of marketing, in administration of all sales activities. Ray H Anders succeeds Mr Markley as manager of industrial products dept. Maximilian H Leister becomes general manager of motor products dept.

Executive officers of **C H Wheeler Mfg Co** now are C M Brown, chairman of board; P S Lyon, president and general manager; F L Yetter, vice-president; L A Droescher, vice-president; J J Bolton Jr, vice-president; and J S Gabel, secretary and treasurer.

**Cooper-Bessemer Corp** announces appointment of J T Weissenburger as manager of its parts dept.

George A Mattucci has been made marine manager of Great Lakes district for **Babcock & Wilcox Co.** His headquarters will be in Cleveland, O.

**Plibrico Jointless Firebrick Co,** Chicago, Ill., appoints Earl C Hawley manager of Plibrico Sales & Service Co, 2nd Unit Santa Fe Bldg, Dallas, Tex.

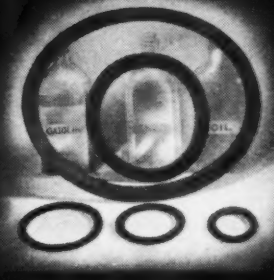
Joseph J Gilbert has returned to **Link-Belt Co** from his wartime service. He assumes position of sales engineer, sanitary engineering div. His headquarters will be the Philadelphia plant.

**Tube Turns, Inc,** promotes Jack Green to sales manager of welding fittings div. Succeeding him as assistant sales manager of this div is Tom Pike. The company has opened an office in Detroit in charge of Jack Ellsworth. He will represent forging and welding fittings divisions, his territory including Michigan, northeastern Ohio, northern Illinois, and Indiana except Whiting and East Chicago.

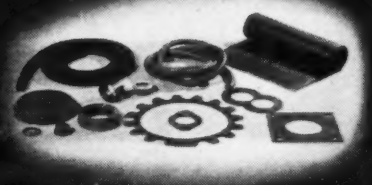
Gwilym A Price has been elected president of **Westinghouse Electric Corp** to succeed George H Bucher, who has resigned. Under a recent amendment of the bylaws, Mr Price will be the chief executive officer. A W Robertson, who as chairman has been chief executive officer since 1929, has reached retirement age. He was elected chairman of the board under the new bylaws and will continue as a member of the organization in a less active capacity. Mr Bucher was elected vice-chairman of the board and will continue as chairman of Westinghouse Electric International Co.

**Westinghouse Electric Corp** appoints H D Moreland manager of X-ray div, Baltimore, Md., succeeding A P Craig, who leaves for Hamilton, Ont., where he will become assistant to president of Canadian Westinghouse Co. W E Lee has been named manager of the company's Phoenix, Ariz., office. A L Atherton has been made advisory engineer and Fred C Heyl manager of quality control dept at East Springfield, Mass., plant. D J Mosshart has been promoted to enginnering manager of stoker dept of steam div. He succeeds R A Foresman, who had been on extended service for several months prior to

Woven Asbestos Gaskets



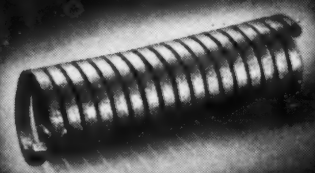
Molded Parts



Compressed Asbestos Gasket Sheet

Asbestos Braided Packings

Plastic Packings



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| Pittsburgh 22, Pennsylvania | 405 Penn Avenue |
| Portland 1, Oregon | 1433 S. W. Front Avenue |
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his retirement. Appointments of Joseph Early as staff assistant to L G Jarrett, superintendent of glass plant, and Mervyn A Hastie as staff assistant to N H Stewart, superintendent of sun-lamp manufacture, have been announced.

Ralph E. Lovdal has been named manager of northern district of **Westinghouse Electric Supply Co** with headquarters in Milwaukee, Wis. He succeeds Roy L Brown who has been transferred to New York City as manager of eastern district. Robert P Smith has been made manager of Midwest district, with headquarters at St. Louis, Mo. Clarence G Ward has been appointed manager of Peoria, Ill., branch, succeeding F D Phillips who has retired.

**Westinghouse Electric International Co** announces formation of a new service dept to help customers in South America and Caribbean area with problems of equipment and operation of electrical machinery. J F Mann was appointed manager of the new dept.

Melvin C Shaw has been named manager of blower and compressor dept of **Allis-Chalmers Mfg Co,** Milwaukee, Wis., succeeding John Avery who has resigned. A W Kremser has been made branch manager of Davenport, Iowa, office. He succeeds C J Schutty, who is being transferred to Kansas City office. Fred W Bush has been promoted to assistant manager of electrical dept at Milwaukee. Frederick C Ludington has been appointed manager of the switchgear and control sections.

**Worthington Pump & Machinery Corp** appoints W A Finn export manager, with headquarters at Harrison, N. J. He succeeds George Gellhorn who has accepted the position of general manager of C E Halaby, one of Worthington's industrial machinery dealers in Colombia, South America.

J W Brauns has been appointed manager of **General Electric Co's** industrial haulage div, succeeding F H Craton who is now assistant manager of transportation divisions. Three new divisions have been added to GE industrial engineering divisions: (1) power electronics div, headed by L W Morton (2) materials handling and testing equipment div, M A deFerranti, engineer (3) rubber and printing div, under direction of C W Knapp. Also, the reorganized machinery div is headed by H W Poole. Revision of construction materials' sales districts has been completed. District offices have been opened in Philadelphia, Pa., and Kansas City, Mo. New appointments among construction materials' district managers include S D Hopper in Great Lakes district, W E Swenson in Atlantic district and O W Cerny in Central district.

Clifford A Russell, Pittsburgh district manager for **Foster Wheeler Corp,** announced appointment of Albert Downham as his assistant.

Edward W Gamble Jr becomes sales assistant to the president of **Monsanto Chemical Co.** Herbert F Weaver has been made production manager of phosphate div, succeed-

● The widespread use of triple-alloy steels containing Nickel, chromium and molybdenum is based on extensive experience in widely divergent engineering fields.

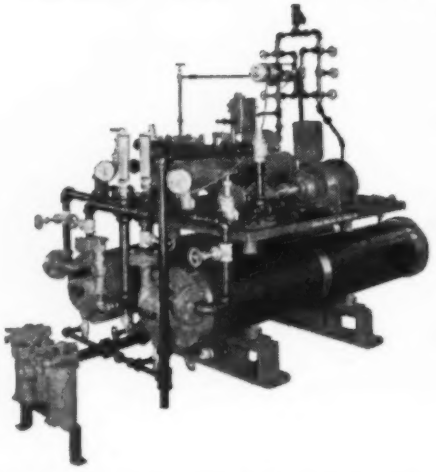
It has been found that they can be counted on for consistent performance. The depth to which full hardness is developed is comparable to that attained by other alloy steels. Their response to heat treatment is dependably uniform.

Moreover, the wide range of compositions available, makes it possible to select *accurately* suitable alloy steels for a broad range of applications.

Inquiries regarding the selection and uses of triple-alloy steels containing Nickel are invited.

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N. Y.

## FABER FUEL OIL BURNING EQUIPMENT



**ASSEMBLED UNIT**
Ready to Run

**ENGINEERED**
To Specification

**CAPACITY**
50 to 5000 Gal. per hour

**AUTOMATIC**
Delivers fuel oil to burners at proper pressure and temperature

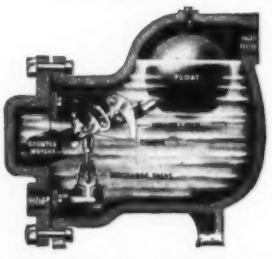
## FUEL OIL PUMP AND HEATING UNITS

Single or Duplex Steam or Electric Pumps.
Single or Duplex Multipass Straight Tube heaters.
TIME TESTED—through years of continuous service, our units have proved their worth.

*Send for Bulletin 45-4*

## FABER ENGINEERING COMPANY
PHILADELPHIA 34, PA.

## Designate
# NICHOLSON TRAPS
***and Be***
**DEAD-SURE**
*of*



## PLANT-PROVED DEPENDABILITY

Fast action, enormous drainage capacity, and ruggedness enabled Nicholson traps to make striking wartime records. Continuing plant tests show that you can depend solidly on Nicholson traps to: (1) Promote production efficiency; (2) Furnish trouble-free long wear. Nicholson makes weight-operated, piston-operated traps; thermostatic steam traps; air, gas, gasoline traps. Pressures to 1500 lbs. For dependable, ready aid on drainage problems, consult Nicholson.

***For Details Send for Catalog 444***

**W. H. NICHOLSON & CO.** 125 OREGON ST. WILKES-BARRE, PA.


ing Edward A O'Neal Jr. J Fred Reeves succeeds him as manager of Monsanto's plant at Anniston, Ala. A T Beauregard will be transferred to St. Louis as special assistant to R R Cole, vice-president and general manager of phosphate div. John L Christian becomes manager of elemental phosphorus plant at Monsanto, Tenn.

**Monsanto Chemical Co** appointed Forrest M Luckett branch manager of organic chemicals div in Cincinnati. His territory includes southern Ohio, northern Kentucky and all of West Virginia except the northern tip and a small portion of the eastern part. T C Tupper is stationed now in organic sales div office at Cleveland. His territory will be northern Ohio. Plastics div announced that it has set up a packaging materials sales dept under direction of R C Evans. Nate L Crabtree has been employed to assist in merchandising textile chemicals. He will serve as special assistant to D S Dinsmoor, general manager of Merrimac div, with headquarters in Everett, Mass. Edward A O'Neal Jr has been promoted to position of deputy managing director of Monsanto Chemicals, Ltd, wholly owned English subsidiary of Monsanto Chemical Co.

R H Munn Jr has been made manager of Pittsburgh office of **Ampco Metal, Inc,** and will act as field engineer in the Pittsburgh territory. W J Nebel has assumed his duties as field engineer in the Newark, N. J., district.

William F Jetter has been elected a vice-president of **Air Preheater Corp.**

**American Locomotive Co** announces appointment of Roland A Sherwood as assistant to the president. George Mason becomes director of information in public relations dept.

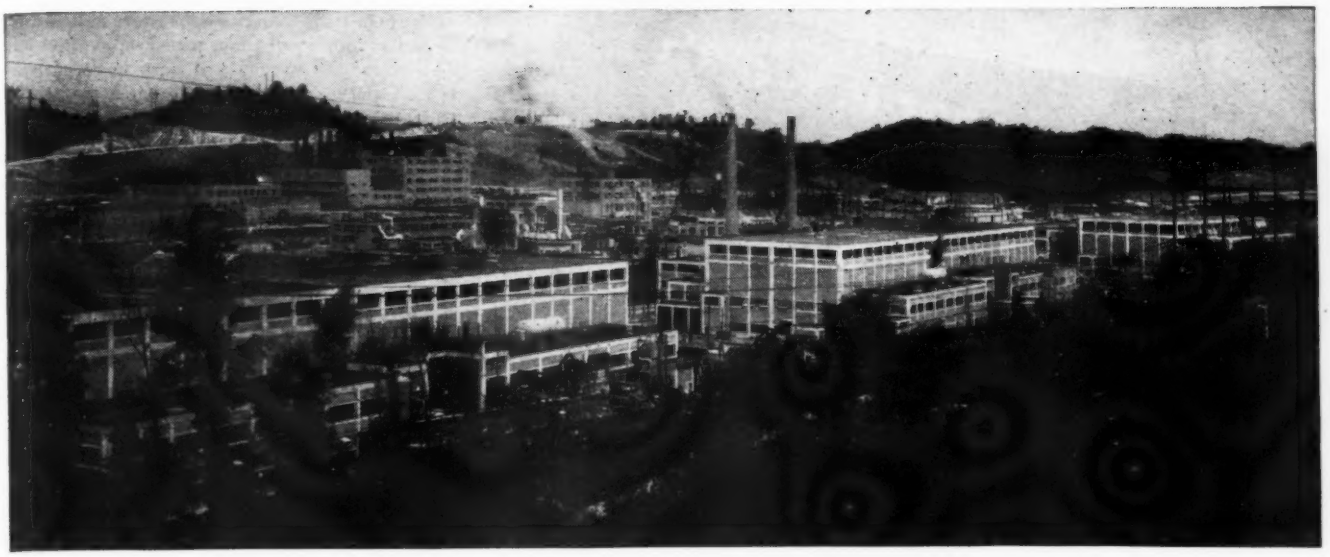
**Bakelite Corp** announces election of Allan Brown and G C Miller as vice-presidents of company.

William G Shipman has been appointed by the **Graver Tank & Mfg Co** as plant superintendent at East Chicago, Ind. H G Sharp becomes general manager.

**Johns-Manville Corp** announced election of L M Cassidy and T K Mial as vice-presidents. Sales organization made following announcements: J A O'Brien, vice-president of Johns-Manville Sales Corp, a subsidiary, has been appointed manager of power products and industrial dept. H R Berlin has been elected vice-president of Johns-Manville Sales Corp and is appointed manager of building materials and general dept. Mr Cassidy and Mr Berlin will serve as members of the officers' board. L R Hoff, vice-president in charge of sales, retired.

Appointment of B & B Combustion Co as Missouri and lower Illinois representative of **Canton Stoker Corp** was announced recently.

L N Zimmerman, Howard B Weeks and Gale B Robinson have been appointed district representatives in the Midwest and Central div of **Iron Fireman Mfg Co.** Mr Zim-



# ELECTROMAGNETIC

**Stone & Webster Engineering Corporation recommended the electromagnetic process among several possibilities as the quickest way to mass produce U-235—the essential element in the Atomic Bomb.**

**How successful this process was is indicated in the Smyth Report.**

**We quote:**

**"Construction of the first series of electromagnetic units at Clinton began in March of 1943 and this part of the plant was ready for operation in November 1943."**

**8 MONTHS TO FIRST OPERATION**

**"For nearly a year the electromagnetic plant was the only one in operation."**

**A YEAR AHEAD IN PRODUCTION**

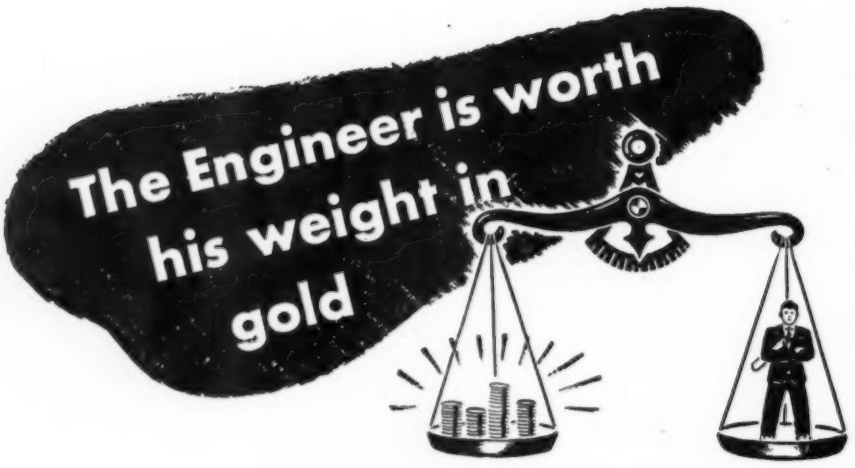
**"The electromagnetic separation plant was in large-scale operation during the winter of 1944-1945 and produced U-235 of sufficient purity for use in atomic bombs."**

**QUALITY AND QUANTITY PROVED.**

ENGINEERS & CONSTRUCTORS
of one of the
MAJOR ATOMIC BOMB PLANTS
AND THE CITY OF
OAK RIDGE, TENNESSEE

## STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.




**No doubt about that: but do the *right* people realize it? Does the front office apply the right scale to weigh your worth? Does the plant management understand that your "know-how" contributes decisively to efficient plant operation? How can you make them see the close relation between your proficiency and their profit?**

**Engineers are rarely inclined to talk about themselves and their work. That is why PREFERRED has brought out a book called "Dividends from your Power Plant"—ten articles on 36 pages that speak for you in easily *understandable* language. Order it—free, of course—and slip it on the manager's desk. Here are a few quotes of what he will read:**

"The Engineer is a Gold Mine but you may have to dig for the ore."

" 'Good' Boilers Can Waste Money by scattering heat into the sky . . ."

"If Steam Were A Raw Material it would get the attention it deserves from plant managers."

"Stack or Fan for Draft?"

"The senisble arrangement of boiler-room equipment makes for less time-consuming labor and more profit-making ideas."

"Your engineer is no salesman. It's up to you to cultivate the profitable habit of consulting him."

"A boiler may be 100% sound according to the insurance agent but 100% as bad economically according to the man who knows—your plant engineer!"

***Send for "Dividends from your Power Plant" today! The sooner your executives realize how your job affects their production the better. The book contains no advertising. It's written in plain non-technical language so that those who are interested in production costs more than in technical data will understand. Just fill out the attached coupon and your copy will be on its way.***

**PREFERRED Utilities Manufacturing Corporation**
1860 Broadway, New York 23, N. Y.
*Manufacturers of the "Unit Steam Generator"*

SIGN AND MAIL TODAY

PR-110

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY NEW YORK 23, NEW YORK
Please send me FREE and without obligation, bulletin #1000 and the ten articles in booklet form, titled—"Dividends From Your Power Plant".

Clip and Mail Today

Name.....
Company Name.....
Street.....
City.....State.....

P346

PREFERRED UTILITIES


merman will cover southeastern Michigan and northwestern Ohio, with headquarters in Detroit. Mr Weeks will have headquarters in Decatur, Ill.; Mr Robinson, in Connersville, Ind. David H Butler has been made sales manager of Toronto factory branch of Iron Fireman Mfg Co of Canada, Ltd.

**American Brake Shoe Co** announces the purchase of Joliette Steel Ltd. Company will be operated by the present management, working under direction of Brake Shoe's American manganese steel div. Joseph B Terbell will head the company and J. L. Mullin will be vice-president.

Fred E Harrell, general works manager of **Reliance Electric & Engrg Co,** was elected a member of board of directors.

**Lincoln Electric Co** announces addition of following district office representatives: (1) Frank Boucher has been made welding engineer in Detroit, Mich., area. (2) R K Kewley becomes welding engineer in Cleveland, O., territory. (3) G B Moseley has been appointed welding engineer in St. Louis, Mo., area. (4) L J Cogan, recently released from U. S. Army, has returned to his duties as welding engineer in Philadelphia area. Philadelphia office was moved from N Broad St to 3938 Market St.

Korfund Co has been named sole distributor of **Armstrong Cork Co's** standard density *Vibracork.*

Crocker-Wheeler div of **Joshua Hendy Iron Works** has announced appointment of I C Smith as chief engineer.

C L Gould has been placed in charge of the new San Francisco office of the Roto div of **Elliott Co.**

Appointment of William H Marion to represent **Progressive Welder Co** has been announced. He maintains offices at 320 Ontario St, Toledo 2, O.

**Maxim Silencer Co** will handle all business in Vt, N. H., Me., Mass. and R. I. direct from main office in Hartford.

**Penn Industrial Instrument Corp** purchased the flowmeter div of Cochrane Corp. Penn will manufacture the present line of Cochrane flowmeters exclusively for the Hays Corp, who will market them under the name Hays-Cochrane meters. W B Heinz and F W Hankins are named as Penn directors.

**Davis Engrg Corp** announces appointment of C Edward Bernard as manager of agency sales.

**Ashton Valve Co** has acquired the valve div of Lombard Governor Corp. John F String joins company.

**Leslie Co** announces appointment of following agents to handle industrial sales and services: (1) H F Eastman Co, Boston, Mass., eastern Mass. (2) Wilson Engrg & Sales Co, Cleveland, O., north central O. (3) Modern Electric & Engrg Co, Fremont, Neb., eastern Neb. and western Iowa. (4) Mooney Engrg Co, Kansas City, Mo., eastern Kan. and

## ASBESTOS IN ACTION
### WITHSTOOD BOTH
# HURRICANE
### *and*
# FIRE!

ASBESTOS IN ACTION
HIGH, WIDE and HANDSOME!
. . . and SAFE because it's sheathed with "Century" APAC
THE striking architecture of this Navy Blimp hangar is its own tribute! The doors are like skyscrapers 120 feet high 220 feet wide weighing 300 tons. And they must open the entire width of the hangar in TWO MINUTES.
These giant portals must be the masters of wind and weather—for failure to open and close quickly might spell the doom of a wind-tossed Blimp. So they are completely sheathed with "Century" Apac—K&M's low cost asbestos-cement sheet material. It is rot-proof, rust-proof and fire-resistant.
In thousands of industrial plants, K&M "Century" Apac is used for roofing and siding, office paneling, sheathing in machine shops and stock rooms, linings for elevator casings and shower stalls. It is ideal for new construction, repairs or plant additions.
Enormous quantities of "Century" Apac have gone into wartime jobs. YET NOW THERE'S PLENTY AVAILABLE FOR YOUR INDUSTRIAL CONSTRUCTION WORK without delay, without restrictions.
Check these "Century" APAC advantages for construction and renovation work
Nature made Asbestos
K&M best in asbestos
KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

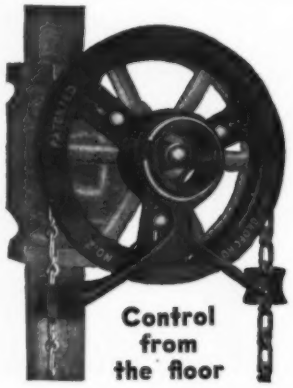
This advertisement originally appeared in April 1945

**BETTER THAN we had anticipated** . . . the outstanding performance of K&M "Century" APAC used as sheathing on the hangar doors of the Richmond, Fla., Naval Air Station. While the hangars themselves were completely destroyed by the fire and hurricane of September 16th, the *doors remain intact.* On-the-scene estimates indicate that *only* 5% of the APAC sheets were damaged . . . necessitating repairs of a very minor nature, considering the magnitude of the disaster. LET THIS OUTSTANDING BUILDING MATERIAL GO TO WORK FOR YOU.

# KEASBEY & MATTISON
## COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos

## Make Your Overhead Valves SAFE and Easy to Reach---




With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

**BABBITT STEAM SPECIALTY CO.**

New Bedford, Mass.

## Gives You

LONG, TROUBLE FREE SERVICE!

Fig. 1635

## "STANDCO"

**PILLOW BLOCKS**

The attractive "Standco" Pillow Block shown above is sturdily built and is offered in a wide range of sizes. Babbitted and broached bearing surfaces, accurately machined faces. Can be amply lubricated.

***Write for Bulletin***

"Unbrako" and "Hallowell" products are sold entirely through distributors.

**STANDARD PRESSED STEEL CO.**

JENKINTOWN, PENNA., BOX 577

Boston • Chicago • Detroit • Indianapolis
St. Louis • San Francisco

## VIKING

1911 - 1946

35 Years of Service

**In a post war world like we are now experiencing, many things will come to pass that will mean great or small loss to a large number of companies. We are referring to new and untried products being developed by new and untried companies.**

**It will pay you well to remember when buying new equipment that the reliable company building reliable products will be able to help you not only in this hectic period, but will be ready to serve you in the years ahead.**

**Write today for Bulletin Series 46SW which illustrates and describes the complete line of Viking rotary pumps.**

VIKING PUMPS — FIRST IN AMERICA

## VIKING Pump COMPANY

CEDAR FALLS, IOWA


western Mo. (5) Walz & Krenzer, Inc, Rochester, N. Y., midwestern New York. (6) Gulf Engrg Co, Savannah, Ga., southeastern Ga. (7) Robinson Electric Co, Vancouver, B. C., Canada, British Columbia.

**De Laval Steam Turbine Co** names H H Barrows and his organization, the Industrial Equipment Co, Detroit 2, Mich., as their sales representatives throughout the lower Michigan peninsula for the IMO pump and worm-gear divisions.

**Dampney Co of America** promotes Lachlan W MacLean to Boston sales office manager. Company also announces its acquisition of Thurmalox Co, Doylestown, Pa.

**W B Connor Engrg Corp** announces return of J E Orr as advertising manager. Company appointed following to handle line of *Dorex* air-recovery equipment and *Kno-Draft* diffusers: (1) George W Stetson, Boston, Mass. (2) Hunter-Hoffman Co, Greensboro, N. C. (3) Dwight L McNulty, Chattanooga, Tenn. (4) Ashton Heating & Air Conditioning Co, Salt Lake City, Utah.

Royal L Meyer has been named vice-president of **Swartwout Co,** in addition to his duties as chief engineer and assistant manager of steam div. E H Bellard becomes sales manager of ventilator div.

William A Marsteller has been appointed general advertising manager of **Rockwell Mfg Co,** Pittsburgh, Pa. Gehnrich oven div has moved to new general headquarters at 200 Eliot St, Fairfield, Conn.

Acquisition of **Arcade Mfg Co,** Freeport, Ill., by Rockwell Mfg Co was announced. Present management will be continued except that L L Munn, for many years president of Arcade, will retire within the near future.

**Edward Valves, Inc,** appoints E B Pool to an experimental research position on valves.

Covering parts of Ind., O., and Mich., **Bigelow-Gibson, Inc,** announced opening of their new distributorship for industrial rubber products at 1026 Water St, Toledo, O. Principal items supplied by the company are the industrial hose, and conveyor and transmission belts manufactured by Hewitt Rubber Corp, Buffalo, N. Y.

Clarence L Johnson, a member of sales staff at Dugas office at Chicago for **Ansul Chemical Co,** was appointed manager of that office. He succeeds Floyd M Duvall, who has been transferred to Indianapolis where he will be district manager of refrigeration sales.

**Sarco Co** announces opening of their Washington, D. C., office at 1129 Vermont Ave, N W, with H F Collins in charge.

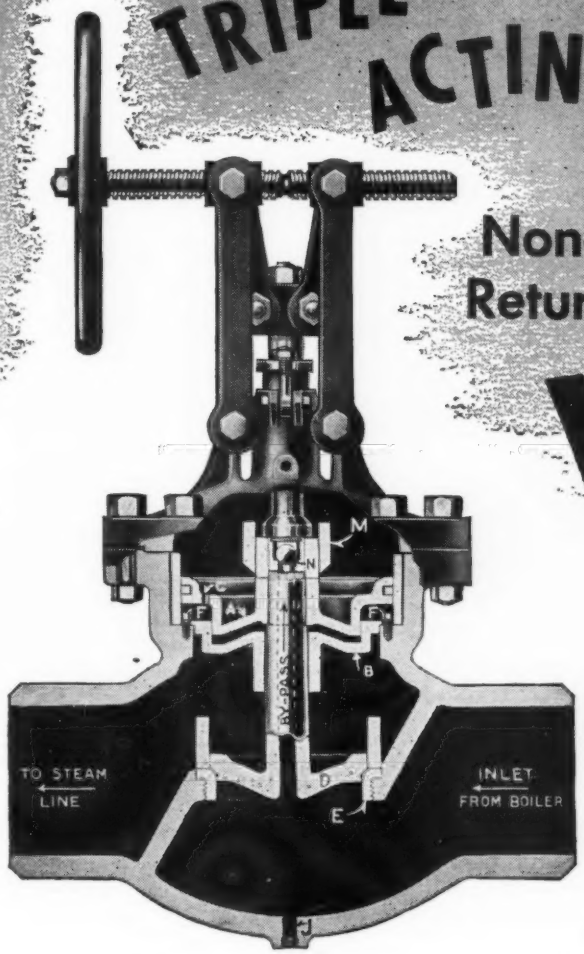
H W Surbrook has been appointed comptroller of **Detrex Corp.**

Lloyd L Smith has turned over his office and accounts to **Edward G Moninger,** who has been identified with M H Detrick Co of Chicago for the past ten years. The office will be operated under Mr Moninger's name

GOLDEN-ANDERSON

# TRIPLE ACTING Non-Return VALVES

1. Will automatically cut in a boiler when its pressure equals line-header pressure.
2. Will automatically isolate a boiler whenever its pressure, from any cause, is lower than line-header pressure.
3. Will prevent steam flow from boiler in event of sudden drop in line-header pressure below the boiler pressure.




for

## *Engineered Protection*

For maximum flexibility, safety and precision accuracy, put Golden-Anderson Triple Acting Valves in your boiler room.

- Prevents banging, chatter or spinning under any flow condition.
- All moving parts are in constant, perfect alignment.
- Built double extra heavy to prevent distortion or warping under pipe line stress and strain.
- Unfailing automatic operation for absolute safety.
- Available in bronze, monel, stainless steel or Gavalloy.
- Angle, Globe or Elbow patterns; sizes 2½" to 12" and larger sizes in the Cross pattern.

*Let*

**GOLDEN-ANDERSON**

***Engineers***

Work with you now, on any new or replacement problem involving high pressure flow control. Write for descriptive, technical catalog.

write for descriptive technical catalog

GA

GOLDEN-ANDERSON

VALVE **Specialty Company**

FULTON BUILDING • PITTSBURGH 22, PA.

# 3 STEPS TO FEWER PACKING REPLACEMENTS

**1.** Make up your mind to put an end to power-wasting leaks and frequent time-wasting replacements.

**2.** Ask the Belmont distributor to show you the handy PACKING RECOMMENDATION CHARTS.

**3.** Standardize on the right Belmont packing at every point.

**Belmont Distributors** are located in every large industrial center, ready to serve you promptly from local stocks. Get the PACKING RECOMMENDATION CHARTS from the one nearest you — or send the coupon to us.

THE BELMONT PACKING & RUBBER CO — BELMONT — PHILADELPHIA, U.S.A.

*on the blue-and-orange box*

**THE BELMONT PACKING AND RUBBER COMPANY**
**Butler & Sepviva Streets, Philadelphia 37, Pa.**

*Gentlemen:* Please send PACKING RECOMMENDATION CHARTS for the services checked:

☐Steam . . . ☐Hot Water . . . ☐Cold Water . . . ☐Brine . . . ☐Ammonia . . .
☐ Acids & Caustics . . . ☐ Air . . . ☐ Gas . . . ☐ Oil . . . ☐ Gasoline . . .
☐ Asphaltic & Tar Products . . .

*Name* .....
*Company* .....
*Address* .....


and Mr Smith, who will be associated, will assist with the Beaumont Birch Co, A W Cash Co and M H Detrick Co accounts. The business will be continued at 605 Plymouth Bldg, Minneapolis, Minn.

**Hahn Engrg Co,** 30 Church St, New York 7, N. Y., announces formation of Hahn Equipment Corp of the same address with Eugene Hahn as president and Robert Gordon as secretary-treasurer.

John O Logan has been appointed assistant general manager of sales of **Mathieson Alkali Works.** Harry P Smith has been made New York district sales manager, a post formerly held by J B Peake, who continues as assistant general manager of sales.

Henry L Parry, of **Parry Engrg Co,** who recently completed over five years' service with U. S. Navy, returned to business. This company represents the Thermix Engrg Co and Prat-Daniel Corp.

K W Green has been appointed manager of the newly consolidated railway and engineering sales div of **Electric Storage Battery Co.**

**Wagner Electric Corp** promotes G B Evans to plant manager. C W Hesse succeeds him as general superintendent. W A Okenfuss has been made assistant general superintendent.

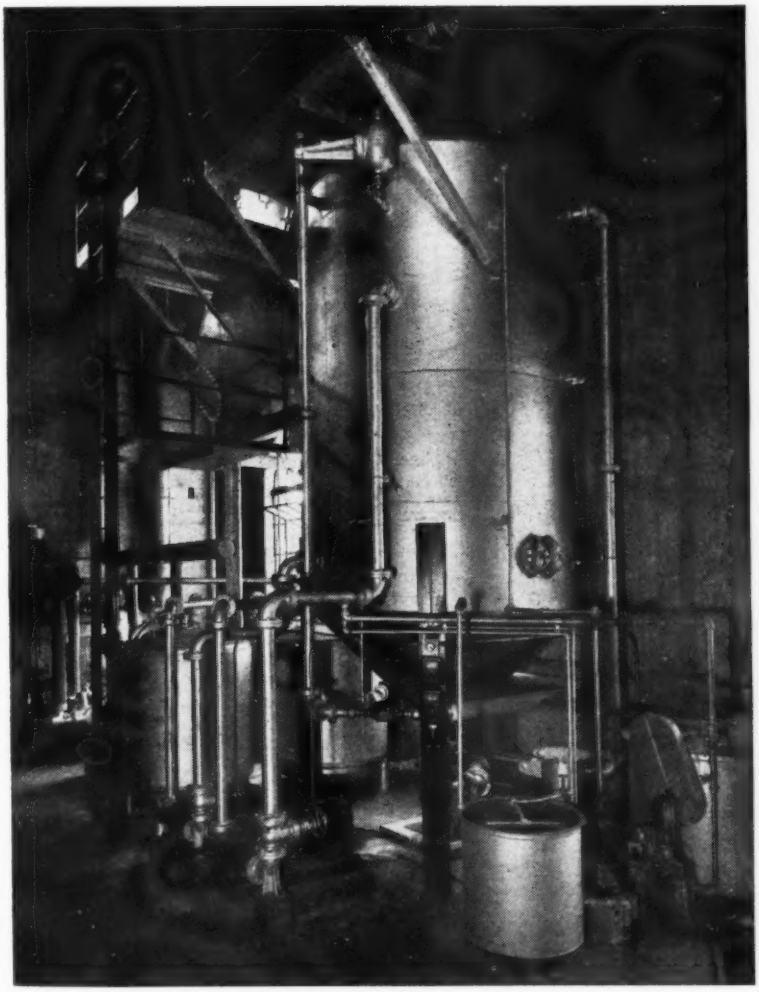
Following sales engineers have been added by **Brown Instrument Co** to branch offices of Minneapolis-Honeywell Regulator Co of which the Brown company is the industrial div: D L Russell assigned to Boston; A F Cecere to Hartford, Conn.; J. A Rorex to Houston, Tex,; R Mitchell, A D Mayo Jr and H W Greisback, Chicago; C C Spousta Jr and A R Willy, Indianapolis; D F DeVine, Portland, Ore.; W H Palmer and Ross Hubley, Minneapolis; J Dunlap, Toledo; H W Araucz, Detroit; A T Challman, San Francisco; H T Noonan, Buffalo; L T Macgill and A M Zellar, Philadelphia; C McIntire, Cincinnati; R D Bailey, Washington, D. C.; J F Stein, St. Louis; H W Sinewe, Pittsburgh; R A Wolfe and E G Brown, New York City; R F Bruckart, Cleveland.

Service engineers added to **Brown Instrument Co** staff are the following: G F Neill and C Vivion assigned to Atlanta, Ga.; W W Weaver to Boston; J J Asklar, Hartford, Conn.; C Hornbacker and J P Chuchman, Chicago; M T Glass, Dallas; A T Nicholls, Buffalo; A Bernard, Montreal, Can.; O P Kelly, Syracuse, N. Y.; H E Luther, Indianapolis.

**Automatic Temperature Control Co** elects George C Crewson Jr as their exclusive representative in the Chicago area.

**Taylor Instrument Companies** announced following changes in personnel of the sales organization: (1) J E Hart returned to the company and was made manager of Boston sales office from which point the New England territory is covered. (2) R E Flikkema was transferred to Tulsa to take charge of that branch. (3) A R Wagner will be with Mr Flikkema at Tulsa. (4) F C Fuzzard was

# RAW WATER IS TOUGH.....



. . . tough on boilers. The free carbon dioxide, oxygen, and scale-forming solids in raw water cause scaling, pitting, and corrosion in boilers and boiler-feed equipment.

These dangers can be eliminated by installing a single unit . . . a Graver Hot Process Water Softening and Deaerating system. This equipment has built-in Deaerating and Condensate Heating facilities which enable it to do the complete job of boiler-feed water conditioning. This includes:

1. Softening the raw water to .5 gpg hardness and removal of all scale-forming ingredients.
2. Heating the raw water and the condensate return to within 2° of the temperature of the steam.
3. Deaerating the condensate and the treated water for removal of oxygen and free $CO_2$°.

This three-in-one system does the whole job . . . removes the danger of pitting, scaling, and corrosion . . . insures maximum heat transfer . . . improves boiler operating efficiency . . . and materially cuts operating costs.

Efficient economical operating is assured when the Graver Hot Process Water Softener and Deaerating system is on the job. For complete details and cost estimates on this, or any other type water conditioning equipment, consult Graver. Write, Wire or Phone for immediate attention. There's no obligation.

GRAVER

WATER CONDITIONING EQUIPMENT

*Fabricated Steel Plate Division of*

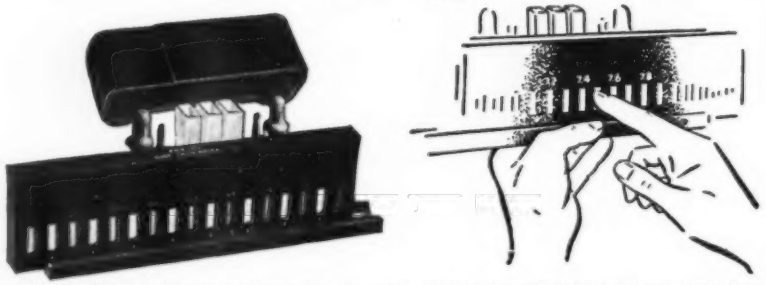
**GRAVER TANK & MFG. CO., INC.**

**General Offices: 4809-25 Tod Ave., East Chicago, Indiana**

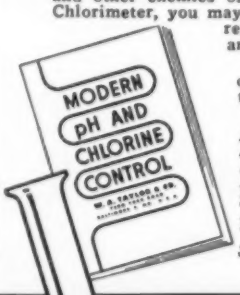
NEW YORK CHICAGO CATASAUQUA, PA. TULSA, OKLA.
PHILADELPHIA PORT ARTHUR, TEX.
EXPORT DEPT., 424 MADISON AVE., NEW YORK, N. Y.

Hot Process Water Softeners • Zeolite Water Softeners
Water Filters • Taste and Odor Removal Filters • Iron Removal Filters • Oil Removal Filters • Chemical Mixing and Proportioning Equipment • Demineralizers

● GIVE YOUR COOLING WATER A CHANCE TO DO AN *Efficient Job!*



Proper chlorination of cooling water in your condensers will effectively control slime and other enemies of efficient heat transfer. Now, with the Taylor-Enslow Slide Chlorimeter, you may make a periodic *two-minute test* and be certain of the proper residual concentration of chlorine at all times. It's easy, fast and accurate, will save you its cost many times over.



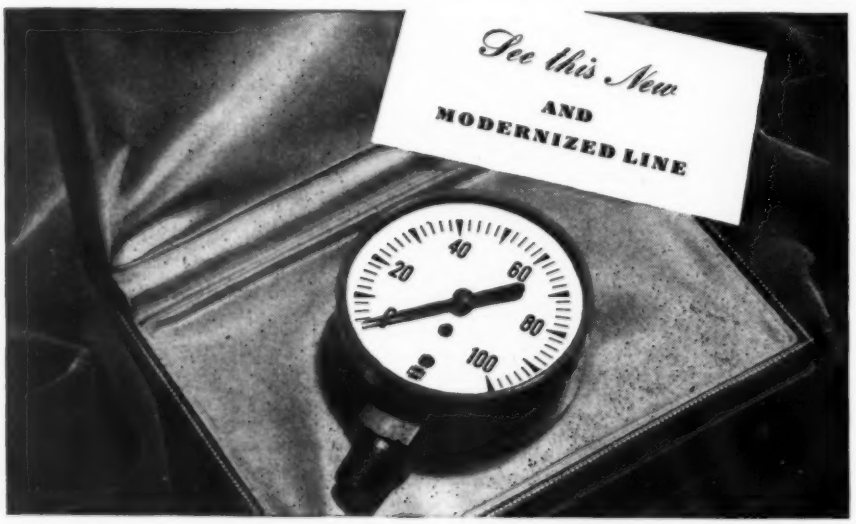

With a Taylor-Betz Nitrate slide comparator, you may quickly determine the nitrate concentration and minimize caustic embrittlement.

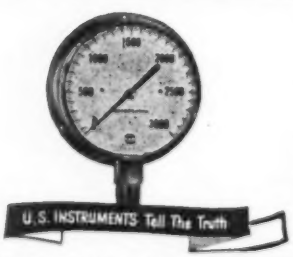
All Taylor Color Standards carry AN UNLIMITED GUARANTEE AGAINST FADING . . . assure lifetime accuracy.

| | |
|---|---|
| Taylor-Enslow Slide Chlorimeter, 0.0 — 1. Oppm | $18.50 |
| Taylor-Enslow Slide Chlorimeter, 0.0 — 3. Oppm | $18.50 |
| In wooden carrying case | $23.50 |
| Taylor-Betz Nitrate Slide Comparator | $18.00 |
| In wooden carrying case | $25.00 |

*See your dealer. Write today for new, authoritative booklet, "MODERN pH AND CHLORINE CONTROL".*

**W. A. TAYLOR AND CO.**
YORK & RODGERS FORGE RDS. • BALTIMORE-4, MD.




The new U. S. Gauges are radically improved. Precise as always but now functionally styled to bring you new *appearance*...new *readability*...new *sturdier construction*.

When you run your eye over the pleasing lines and smart colors . . . when you notice the visibility of the graduations . . . when you consider the years of engineering and research directed toward bettering life, quality and durability . . . you'll say, "They're the gauges for equipment we buy, use, or sell!"

UNITED STATES GAUGE, SELLERSVILLE, PA.

USG **UNITED STATES GAUGE**
DIVISION OF AMERICAN MACHINE AND METALS, INC.
*Manufacturers of Pressure, Temperature, Flow and Electrical Measuring Instruments*


that territory. (6) J A Grant has returned to Philadelphia to be part of that sales organization.

**International Nickel Co** opened Twin Cities technical section of its development and research div. It is in the Northwestern Bank Bldg, 620 Marquette Ave, Minneapolis, Minn. The new section, under direction of J C Neemes Jr, will furnish technical assistance in territory embraced by the states of Minn., N. D. and S. D., northern two thirds of Wis. and northern portion of Mich.

**Sterling Engine Co** elects Robert E Dillon to board of directors.

James Adair joins **Star Electric Motor Co** sales engineering staff. He will represent the company in the New Jersey area.

**Allen-Bradley Co** announces appointment of Muth-Richards Co, 1426 Broadway, Seattle 22, Wash., as its new representative in the Seattle area.

After five years of military service, Lewis L. Dollinger Jr is again associated with **Dollinger Corp.** In addition to duties connected with his recent election as vice-president of the company, Mr Dollinger will act in a sales engineering capacity.

S V Reiss joins **Graybar Electric Co** as manager of commercial research. Burton R Cole takes over duties of communications sales manager.

James F Olsen, formerly sales manager of Turbo-Mixer Corp, a unit of General American Transportation Corp, has been transferred to Chicago office of **General American Process Equipment** as manager of sales. James A Lane has been transferred to the New York office as assistant to sales manager of General American Process Equipment.

**Lockwood Greene Engineers, Inc,** elects William J Heiser a vice-president.

E A Taylor joins **Allied Control Co** as general sales manager. J S Speer has been appointed eastern sales manager. Hugh M Noble will be western sales manager, with headquarters at Chicago. Lewis A Jones has joined the company as director of procurement.

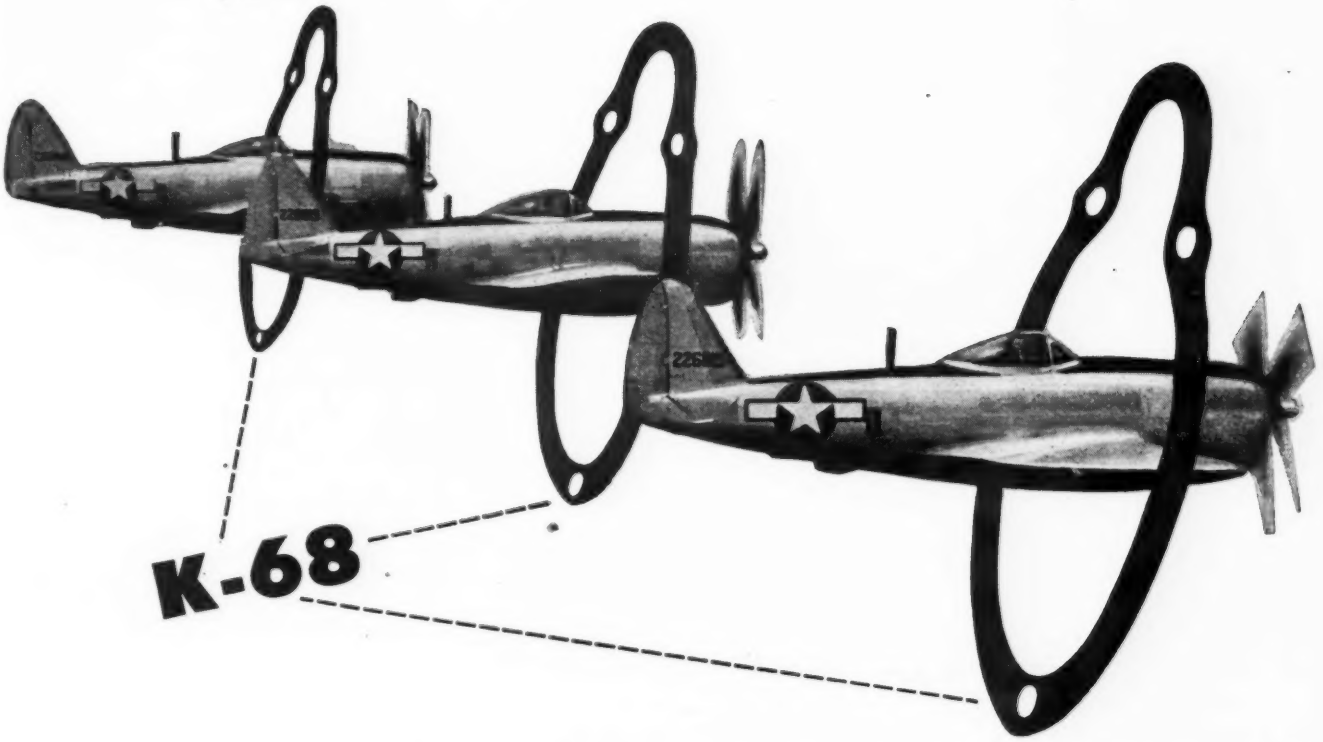
C E Cook has been named to head the new circuit breaker div of **Aireon Mfg. Corp.** He will have the title of manager.

LeRoy M Davis has joined the engineering staff of **Public Utility Engrg & Service Corp** as assistant hydraulic engineer.

**Eastern Gas & Fuel Associates** elected Graham Granger assistant vice-president and appointed John Mitchell director of a newly organized research dept.

Howard M Waybright has been named general traffic manager in charge of traffic activities for all divisions and subsidiaries of **Eastern Gas & Fuel Associates.** His

# NOW IT CAN BE SOLD!




## K-68, the War-Born, Heat-Proof Sheet Packing That Stops Oil-Leaks in Hot Spots

In a supercharged, high-output engine, if an oil-leak develops, fire breaks out. Yet, at the beginning of the war, the gasket-material did not exist that could stand up in some of the newer aircraft engines.

Wright Field and the aircraft industry needed material to meet a new specification "AMS 3232" . . . a material that didn't even exist! They wanted elasticity to take care of expansion and contraction in hot engine-parts; heat-resistance to withstand the scorching temperatures; oil-resistance; strength.

When Raybestos-Manhattan were asked to work on the problem, they developed **K-68.** It had extraordinary heat-resistance; unusual tensile strength; was highly resilient; impervious to oil. Throughout the war, it was used in thousands of hot spots in fighting engines. Now it is available for refineries . . . gas plants . . . Diesels . . . gasoline engines . . . wherever heat, oil, and distortion are problems.

**K-68** is just one of more than seventy R/M packings *for every industrial use,* but it is typical of all R/M products. Behind every R/M packing, the research and engineering skill that produced **K-68** is constantly at work to make better packings for your needs. See your authorized R/M distributor for **K-68** and other R/M packings.

*It's "Packed with Satisfaction" when you use* **R/M**

# RAYBESTOS-MANHATTAN, INC.

***ASBESTOS TEXTILE AND PACKING DIVISION***

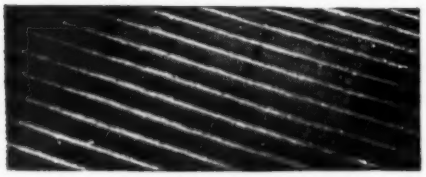
**Manheim, Pa. • Bridgeport, Conn. • North Charleston, S. C. • Passaic, N. J.**

RAYBESTOS R M MANHATTAN

MACWHYTE
Elevator Ropes
SAFETY • SERVICE • ECONOMY
Ask your Elevator Maintenance Man
Tough, flexible wire drawn from selected steels in our own mill goes into Macwhyte Elevator Ropes. Strict metallurgical control at every step of manufacture assures a minimum of stretch, yet ample flexibility to withstand bending fatigue.
Your Elevator Maintenance Man can get these low-cost-per-car-mile ropes from Macwhyte Distributors or Mill Depots.
8 x 19 Macwhyte Special Traction Steel
6 x 19 Macwhyte Traction Steel
PREformed and Non-PREformed elevator ropes
MACWHYTE COMPANY
2944 Fourteenth Avenue, Kenosha, Wisconsin
Makers of the correct ropes for your equipment
MACWHYTE COMPANY 50th Year 1896 – 1946
NO. 849-C

# SPECIFY OPEN STEEL FLOORING

## for maximum light and ventilation!



Hendrick Mitco open steel flooring has rectangular openings that afford maximum light and ventilation —a 90% open area! Mitco performance and service life always measure up to expectations because Mitco's square edge bars are formed into an integral unit and provide a safe, non-slipping, level walking surface. It has no bolts, nuts or rivets to collect dirt and obstruct light. If you will send details of your area to be covered, indicating size, type and location of supports, Hendrick will prepare a Mitco recommendation.

**HENDRICK**
*Manufacturing Company*

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Amorgrids.

46 DUNDAFF STREET, CARBONDALE, PENNA.

*Sales Offices In Principal Cities*


office will remain in Boston. Lawrence Petersen has been made assistant general traffic manager. He will supervise traffic for Eastern's coal div and Koppers' stores. His headquarters will be in Pittsburgh.

**American Transformer Co** has recently made several changes in their executive personnel: (1) Walter Garlick Jr, vice-president, is in charge of sales and its related activities. (2) A A Emlen, vice-president, is in charge of engineering and related activities. (3) W R Smith, works manager, relieves Mr Emlen of all supervision and responsibility in connection with factory operations.

**Iron & Steel Products, Inc,** announces election as vice-president of E D Connell, manager of merchant iron and steel dept.

Campbell & George Co, 379 Brannon St, San Francisco 7, Calif., have recently been appointed by **Allen-Bradley Co** to handle their electric controls in northern Calif.

**Laclede-Christy Clay Products Co,** St. Louis, Mo., has announced purchase of properties and business of Alabama Clay Products Co, Birmingham, Ala. These properties will continue to be operated as the Alabama Clay Products Co, a wholly owned subsidiary of Laclede-Christy. A S Holberg, president of Alabama Clay Products Co, will continue with this company. H W Gethin, manager of Pittsburgh district of Laclede-Christy, will be vice-president and general manager of newly acquired Alabama properties. Main office of Alabama Clay Products Co will continue to be located in Martin Bldg, Birmingham, Ala.

**S Bertrand Barnard,** ME, consulting engineer, announces removal of his offices to 1841 Broadway, New York 23, N. Y.

**American Standards Association** organized an executive committee headed by Howard Coonley. Serving with Mr Coonley on this committee are Henry B Bryans, Frederick R Lack, Clarence L Collens and George H Taber Jr.

**American Chemical Society** announces election of Alden Hayes Emery as secretary and business manager.

Following officers were elected by **National Association of Fan Manufacturers** for 1946: G C Derry, president; R H Nelson, vice-president; L O Monroe, secretary-treasurer.

**Stoker Manufacturers' Association** announces appointment of Lloyd L Connell as technical director.

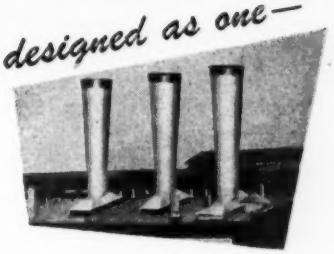
At the annual meeting of **Midwest Stoker Association** the following officers were elected: Joseph G Beard, president; F J Moran, vice-president; E W Jones, secretary-treasurer. The three newly elected officers were also elected to board of directors, together with E M May and A H Porche.

A T O'Neill was elected president of **Buffalo Niagara Electric Corp.** Paul A. Schoellkopf was named chairman of board of directors, while Col William Kelly, whom

# *a 3 in 1 unit*

# FAN-BREECHING-STACK

*designed as one—*

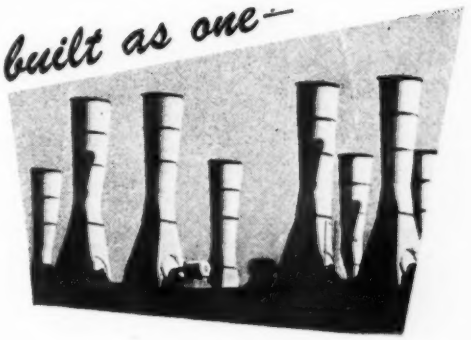


**Mounted directly at the boiler outlet, the Thermix Fan-Stack eliminates necessity for expensive stack supporting structure. This installation method also obviates the necessity for the usual type of breeching to stack, to which many costly draft losses can be traced.**

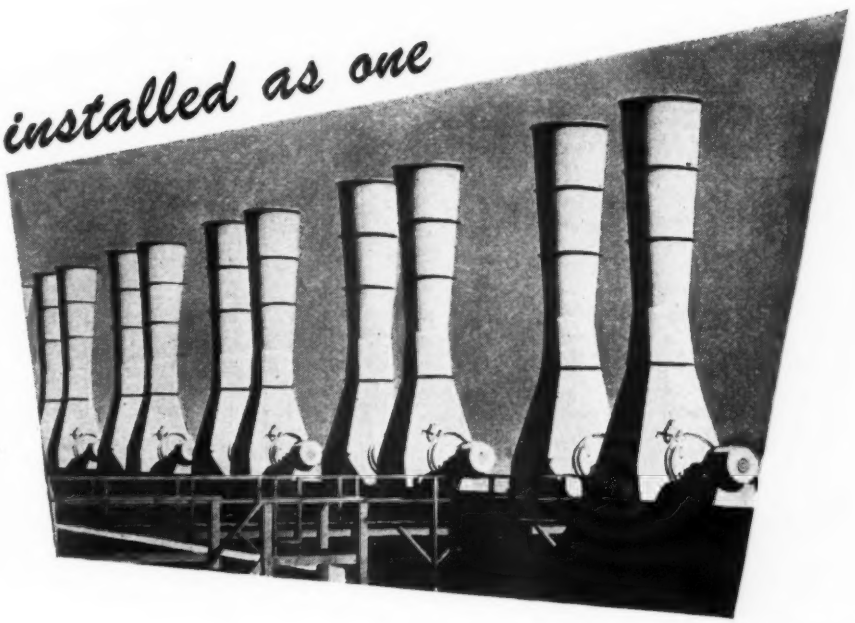
**The Thermix Stack is of the divergent type. The dynamic energy in the gas is converted to the necessary static energy, thus assuring maximum operating efficiency.**

**Check your boiler draft situation—now! It will cost you nothing to let Thermix field engineers make their recommendations. Countless cases throughout industry prove that it may pave the way for an improvement in efficiency, or even an increase in steam output with your existing boiler that will come as a pleasant—and profitable—surprise.**

*built as one—*



*installed as one*



**THERMIX ENGINEERING COMPANY**

*Project & Sales Engineers*

**FIRST NATIONAL BANK BLDG., GREENWICH, CONN.**

# PRAT-DANIEL CORPORATION

**EAST PORT CHESTER, CONN.**

Type DA-31 Pressure Control

**MERCURY SWITCH**
Hermetically sealed mercury switch is used. They cannot be affected by dust, dirt or corrosion; nor are they subject to open arcing, oxidation, pitting or sticking of contacts, all common causes of contact trouble. This switch will give better control service and longer control life.

**BOURDON TUBE**
(Hidden back of cover)
The Bourdon tube is the actuating element of the control. It is the oldest known, tried and proven element, having been used in gauges for many years.

**OUTSIDE ADJUSTMENT**
The outside double adjustment with the calibrated dial and pointers is a convenient feature, making it very easy to set the required operating range, plainly visible on the dial. All guesswork is eliminated.

**GLASS FACE**
The glass face on the cover permits seeing the entire operation of the control in plain view. One can always tell whether the switch circuit is open or closed, a great convenience whenever servicing becomes necessary.

Consult Mercoid on pressure, temperature, liquid level or automatic mechanical control problems.

**THE MERCOID CORPORATION**
**4201 Belmont Avenue**
**Chicago 41, Illinois**

**THE ASSURANCE OF DEPENDABLE SERVICE BUILT IN EVERY MERCOID CONTROL**


Mr O'Neill succeeds as president, will retain his connections with the company as chairman of its executive committee.

**Public Service Co of Indiana** elected Vice-president Garland J Oglebay a director.

Lt Col Francis H King has been appointed manager of **Holyoke (Mass.) Municipal Gas & Electric Dept.**

F B Colbert succeeded R G Wheeler as plant superintendent of **Wisconsin Gas & Electric Co.**

**Frederick G Schranz** has established his own office at 90 W Broadway, New York City, where he will serve as consulting engineer and manufacturers' representative.

Lee W Delhi becomes a member of the pioneer engineering and contracting firm of **Hunt, Mirk & Co,** with headquarters at 141 Second St, San Francisco.

Richard L Boke, a land-use specialist in land utilization work, has been promoted from supervisor of operation and maintenance to director of the Western region of **U. S. Bureau of Reclamation.** The post includes supervision over the Central Valley project.

**Olcott L Hooper,** chief of fuel and conservation branch of recently dissolved Office of War Utilities, joined the industrial management consulting firm of former OWU Director Edward Falck.

Michael W Straus has been made **United States Commissioner of Reclamation.**

Appointment of Robert B Elliott as chief of **Bonneville Power Administration's** Utilization Section was announced.

Marion F Hetherington and Wilbur F Fairlamb have been appointed regional engineers for **Federal Power Commission** at Atlanta and Fort Worth, respectively.

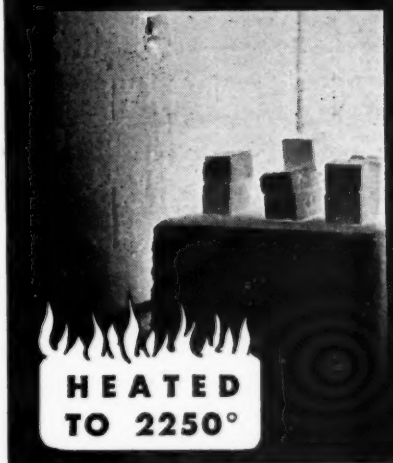
A H Witt has resigned as sales manager of Drayer-Hanson to engage in business for himself under firm name of **Witt Coils.** New organization will handle complete line of commercial refrigeration coils and water coolers and will sell through jobbers only.

John A Lock assumes direction of **Recruitment and Manning Organization** activities on the Atlantic Coast, succeeding Craig S Vincent. Goldie Brussell serves as assistant regional representative.

Jacob Sicherman was made general attorney of **Buffalo Niagara Electric Corp** and subsidiaries.

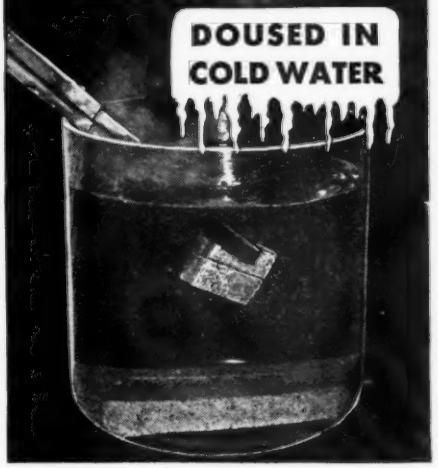
**West Penn Power Co** promoted following employes: (1) John E Mueller has been appointed assistant sales promotion manager and will continue in direct charge of commercial customer activities. (2) Logan R Cole will be transferred to Pittsburgh as manager of residential customer dept, reporting to Sales Promotion Manager Harry Restofski. Residential customer dept is a new subdivision of sales promotion dept and will include all residential sales promotion,


*Demonstrating*
**BRICKSEAL**
**REFRACTORY COATING**



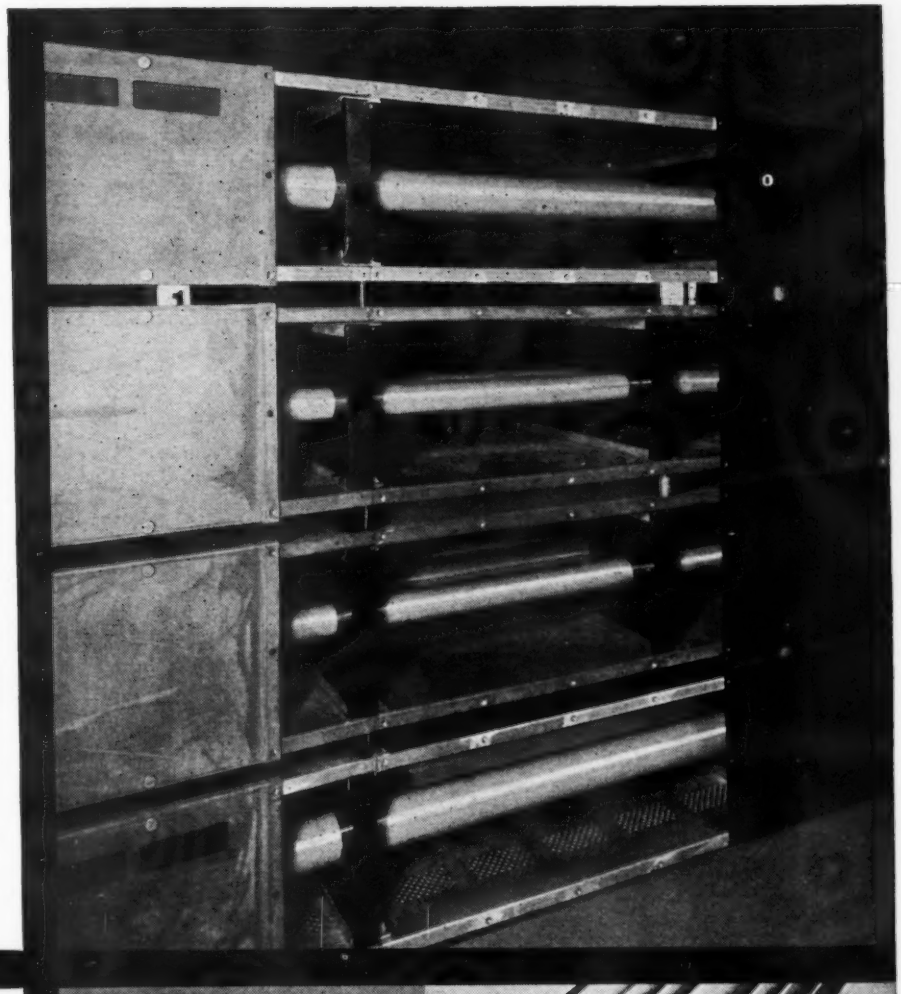

Brickseal provides a crackproof, vitrified armor for furnace linings. The small firebricks shown in the furnace were bonded and painted with Brickseal and heated to 2250°. Directly from the furnace they were plunged into cold water as shown below—a test for *any* material subject to expansion and contraction.

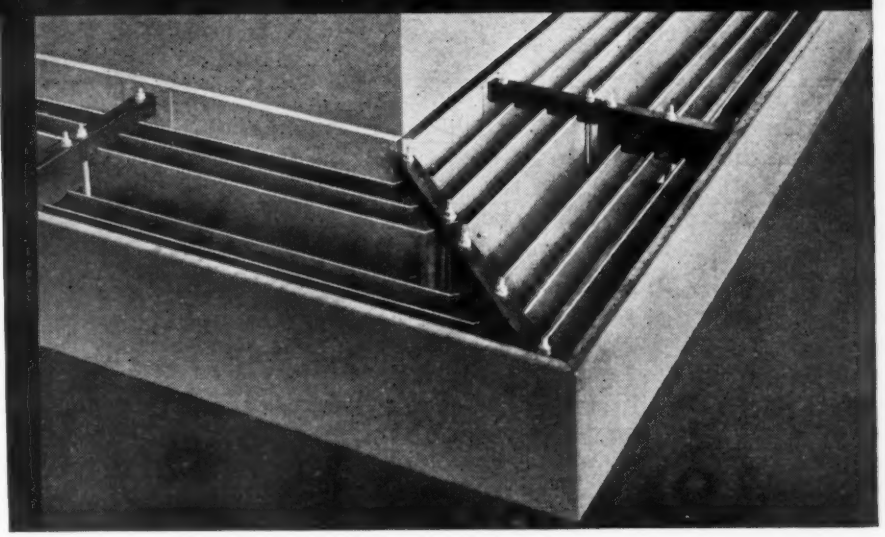
Brickseal is *semi-plastic when hot,* yet *hard and tough when cold.* Brickseal is made in grades suitable to heats ranging from 1400° to more than 3000°. It will make any furnace last longer by giving new life to your refractories. Write or call local dealer for a demonstration.




**BRICKSEAL**
**REFRACTORY COMPANY**
**5800 S. Hoover St., Los Angeles, Cal.**
**1029 Clinton St., Hoboken, N. J.**

# REVERE really knows BUS BAR





WHEN copper became a vital war metal because such large quantities of it were needed for ammunition and other top priority uses, Revere was asked if it could make bus bars out of pure silver. We said "YES!" even though processing of silver for such a purpose had never been attempted. By the end of the war, Revere had produced 36,000,000 pounds of silver bus for aluminum and magnesium plants.

Today, copper bus bar by Revere is back, in all the usual forms, rectangular, round, square, etc. When planning or remodeling an electrical installation, ask Revere to quote on your bus requirements. Other Revere products of interest to those generating or using electricity are condenser tubes and plates, specially-prepared switch copper, copper and brass pipe and tube, commutator bars.

**REVERE**

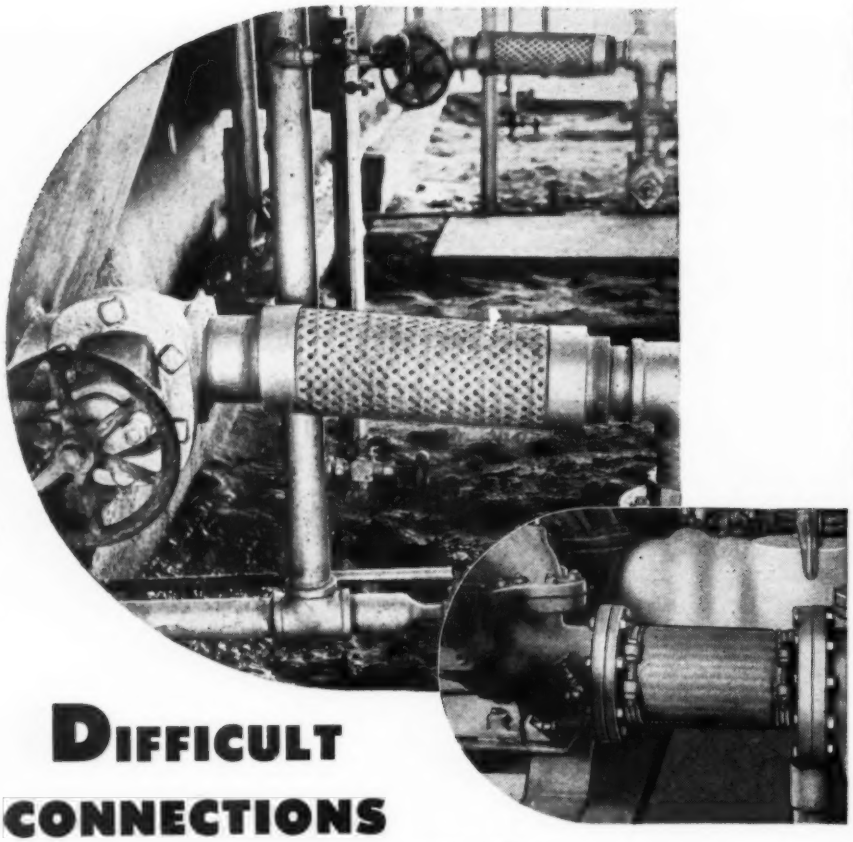
**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

*Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.*
*Sales Offices in principal cities, distributors everywhere.*

Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p.m., EST.



# DIFFICULT CONNECTIONS ARE *EASY* WITH REX-WELD!

Here's Rex-Weld, RW-91—the easy, economical solution to your difficult connection problems! For this Flexible Metal Hose is ideal for

- correcting misalignment
- connecting "hard-to-reach" inlets and outlets
- hose lines that must be frequently connected and disconnected
- temporary hookups

RW-91—made in steel and bronze—withstands temperatures to 1200° F and burst pressures to 2700 p.s.i.—depending on I.D. In addition, it's leakproof and is available with helical or annular corrugations, beamed braid or braided braid. Helical sizes range from 3/16" to 4" I.D.—annular sizes from 5/32" to 2" I.D. REX-WELD, RW-91 is ready to go to work for you now! Ask for Bulletin E-144.

**Flexible Metal Hose for Every Industrial Use**

ARMY E NAVY

CMH

**CHICAGO METAL HOSE CORPORATION**

**MAYWOOD, ILLINOIS**

**Plants: Maywood and Elgin, Illinois**

made acting manager of Pittsburgh territory. (5) A C Mahana is assisting Mr Fuzzard in covering work of dealer, display and home economics sections and electric home bureau. (3) Fred C Schwerer becomes Keystone div sales manager, succeeding Logan R Cole.

Albert A Garthwaite was elected director of **Philadelphia Electric Co.**

Eric T B Gross has been appointed professor of electric power system engineering at **Illinois Institute of Technology.**

Appointment of James S Owens as executive director of **Ohio State University Research Foundation** was announced.

**Niagara Falls Power Co** names Ralph E Robida general superintendent, succeeding Leslie E Ross who died recently. Charles A Clancy becomes Mr Robida's assistant.

Roy Godlay joins **Edison Electric Institute** as rural service manager in commercial dept.

**McLain Organization** appoints John O'Hara Harte as director of public relations and plans.

Edward Donovan has joined the copy staff of **Ross Roy, Inc.**

**Arthur D Little, Inc,** elected following officers: Earl P Stevenson, president; Raymond Stevens and Thorne L Wheeler, vice-presidents; Henry G Powning, treasurer; Frank N Houghton, secretary; Russell H Stephens, comptroller. Directors for the coming year are Marshall B Dalton, W Cameron Forbes, Horace S Ford, Roger C Griffin, Royal Little, Henry G Powning, Charles E Spencer Jr, Raymond Stevens, Earl P Stevenson and Alexander Whiteside. W. H. Avery, Richard Handrick, Winslow A Sawyer, Raymond M Hainer and Richard F Messing join staff.

## OBITUARIES

**Hamilton O Penn,** 49, president of H O Penn Machinery Co, New York, N. Y., died Jan 31 at Chicago where the 27th Annual Convention of Associated Equipment Distributors was held. He was 1945 president of this association.

**James W Welch,** 38, stationary engineer for Standard Oil Co of New York in Buffalo for many years, died recently in Buffalo General Hospital. For past eight years he had been an engineer at the Washington Market in Buffalo.

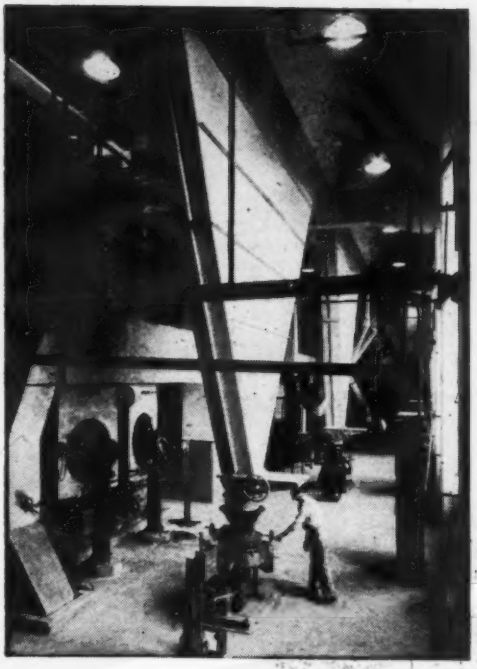
**James Robb,** stationary engineer in Syracuse, N. Y., died in his home there recently.

**Walter Gussenhoven,** 68, former general manager of mechanical goods div of United States Rubber Co, died at his home in Ridgewood, N. J., on Jan 21 after a lingering illness.

**George L Best,** 59, chief engineer at Hotel Lafayette, Buffalo, died recently at his home.

**Otto F Kypta,** who was recently appointed southeastern district manager of construction material sales for General Electric Co. died Dec 28 in Atlanta, Ga.

**Louis E Heusner,** 65, stationary engineer for Buffalo General Laundries for more than 25 years, died Jan 7 in his Buffalo home.

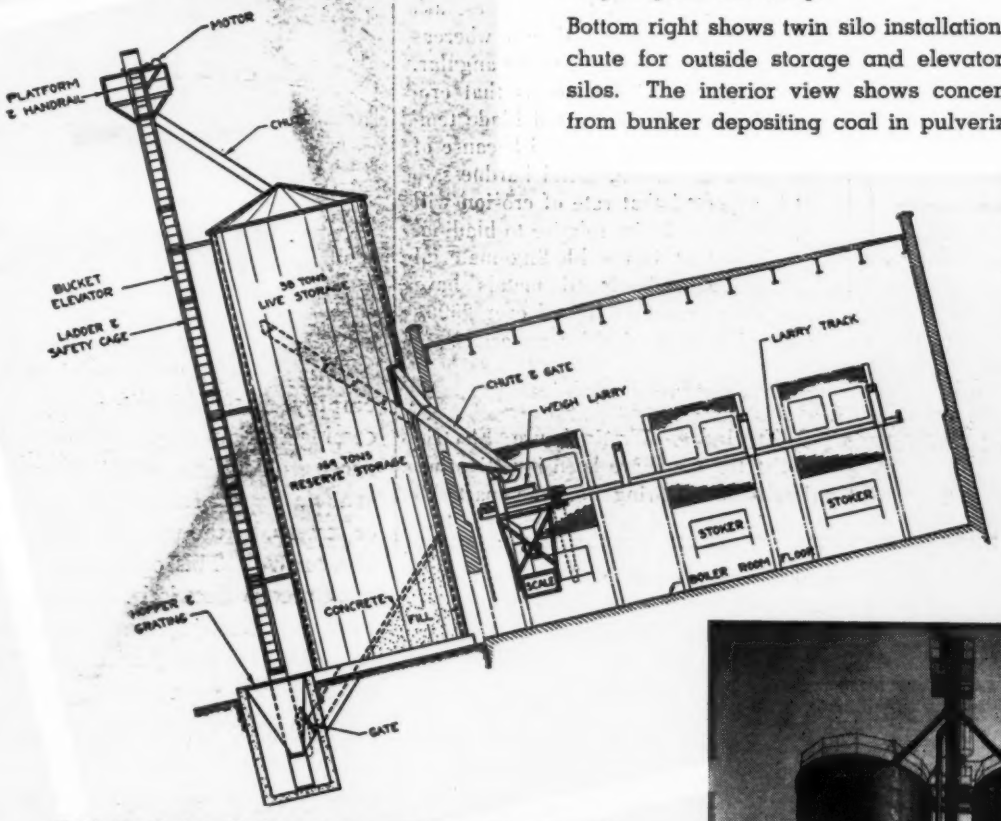


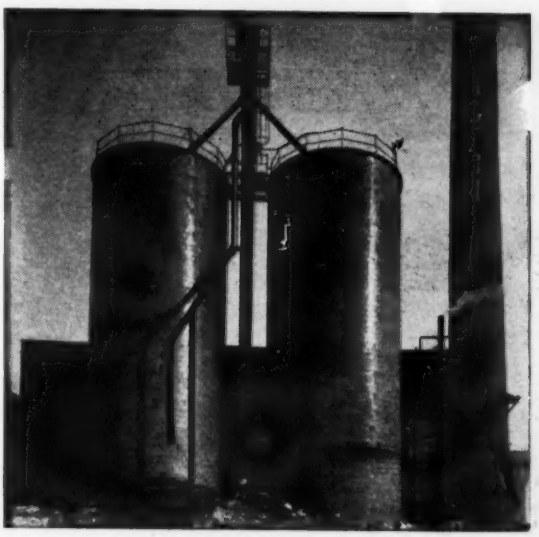
# FAIRFIELD
## *Coal and Ash Handling*
# SYSTEMS

The engineering of coal and ash handling equipment by Fairfield to meet the specific operating needs of your plant assures maximum efficiency and minimum costs.

For example, for storage and handling of coal Fairfield will build an outside silo of vitrified tile or an inside steel bunker depending upon your requirements. The coal is handled automatically from car to storage to stoker or pulverizer. Your boiler room is clean and free from coal dust. Your coal is fed to the boilers to give peak efficiency.

Bottom right shows twin silo installation with overflow chute for outside storage and elevator feeding both silos. The interior view shows concentration chutes from bunker depositing coal in pulverizers.



**Fairfield designs—builds—erects complete coal and ash handling systems. You have but one responsibility for the entire installation. There's a Fairfield representative near you. Consult him on your coal and ash handling system—for reconversion—for extension—for new plant. *Bulletin on request.***

**THE FAIRFIELD ENGINEERING CO.**

*Builders of Coal and Ash Handling Equipment*

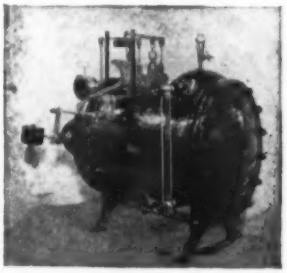
**320 CHICAGO AVENUE • • • MARION, OHIO**

THE EXCLUSIVE

Sterling

**System Boosts Condensate Temperature**

Because it brings the Condensate back to boilers under high pressure, without venting to the atmosphere.



The Sterling System is more efficient than other methods. It makes venting to the atmosphere a gross waste of fuel and money. *It brings condensate back to your boilers with only a nominal line drop in temperature, and makes a deep cut in feed water fuel costs.*

**Sterling Engineering & Mfg. Corp.**
(Templeton Mfg. Co.)
110 Business Street
Hyde Park, 36, Massachusetts

HERCULES
SEAMLESS COPPER
FLOATS

**GUARANTEED**
**TO STAND UP!**

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service. Insure carefree maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

## Coal-Fired Gas Turbine

(*Continued from page 75*)

to develop a pulverized-coal-fired pressure furnace for gas turbines. A second phase of the program investigating blade erosion by high-temperature ash has shown this effect to be dependent upon (1) ash particle average diameter, (2) ash flow (3) gas velocity relative to turbine blade (4) gas temperature (5) blade temperature and (6) blade material.

Degree of erosion varies roughly as the ash particle diameter; however, initial large-particle formation in the furnace is advantageous in achieving better ash separation and thereby decreasing the total ash flow through the turbine. Blading life varies inversely with ash flow.

Erosion decreases with increasing gas temperature. At high temperatures, ash particles have spherical shapes whereas at low temperatures they become angular. While not conclusive it seems that erosion increases with increased blade temperature; this appears logical because of concurrent decreasing metal hardness.

It is expected that rate of erosion will vary with gas velocity relative to blading. Most important is the blading material used; recently developed metals have shown an increase in life of over 200% compared to that of older materials.

### *Superfine Pulverization*

F T Hague, Westinghouse Electric Corp, stated they have been investigating pulverized-coal firing for the past 18 months as applied to open-cycle gas turbines. Superfine pulverization is being studied with the objective of reducing flyash particles to a size where they become nonerosive when passing through the turbine. This would eliminate the need of ash separation.

It is expected to develop a coal-fired combustor with a heat release of 3,000,000 Btu per cu ft per hr compared to the liquid-fuel jet-engine combustor, which operates at above 20,000,000 Btu per cu ft per hr. Many radical changes in combustor design will probably be employed. Principal difference between liquid and solid fuel burning (if the particle sizes are identical) is that most oils ignite at a low temperature whereas coal starts burning at 1200 to 1400 F.

Westinghouse is ready to experiment with full-sized combustors on a 2000-hp gas-turbine unit now in the final stages of assembly. In this way present problems of coal burning can readily be solved in a practical manner.

**STOP FISH**

**BY ELECTRONICS**

This patented fish control method employs modern electronics in overcoming a serious operating and maintenance problem. Fish of all sizes are kept at a *safe distance* from intake structures, or screens, by the use of an Electronic Control Unit. This equipment, generating special electrical impulses, energizes an electrode system designed and engineered for your particular fish control problem.

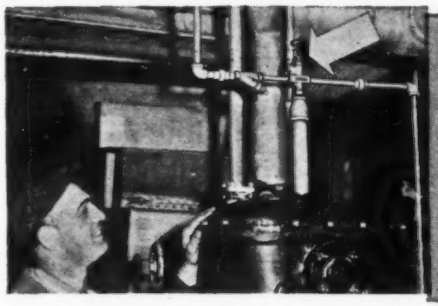
The Burkey Electric Fish Screen has been thoroughly proven through years of service in Condensing Water Intakes, Hydroelectric Plants, Water Systems and Industrial Pumping Installations. DOES NOT STUN OR KILL FISH.

*Recommended by State Conservation Officials.*

*Free literature and quotations upon request.*

**Electric Fish Screen Co.**
1130 No. Poinsettia Place
Hollywood 46, California

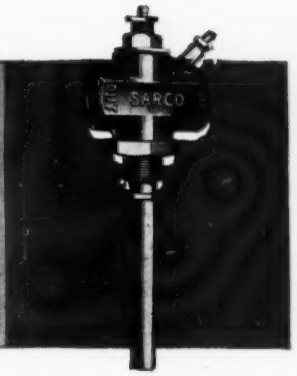
# HOW DOES SARCO SAVE IN THE BOILER ROOM?

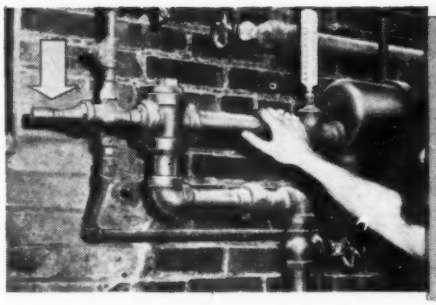


## *Air Compressor Cooling*

Controlled by Sarco TR-40 regulator—saves water, saves oil, increases efficiency, prevents shut downs. Bulletin No. 700.

TR-40

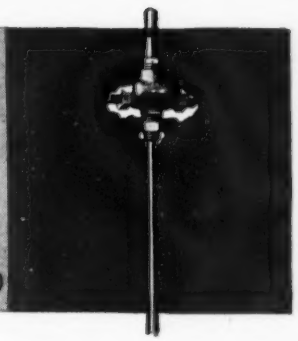


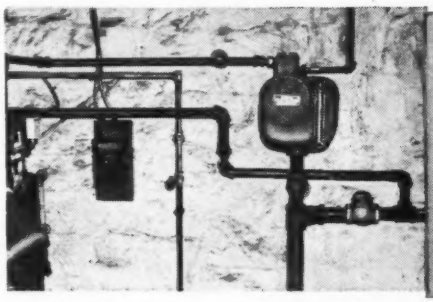



## *Sprinkler Tank Heating*

Controlled by Sarco TR-50 rigid stem control. Uses minimum of heat. Insures enough heat to prevent freezing. Bulletin No. 600.

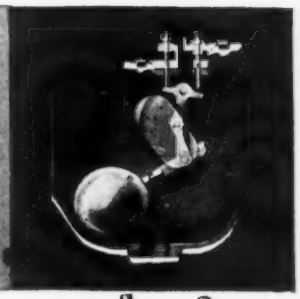
TR-50

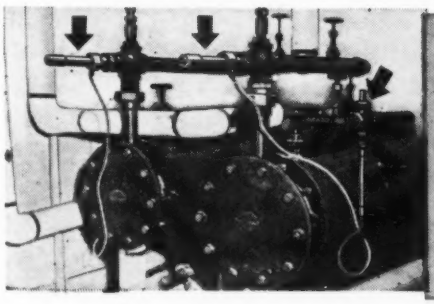




## *Alternating Receiver*

Used as a boiler return trap—or to lift condensate to higher level or pressure. It has modernized many heating systems. Bulletin No. 165.

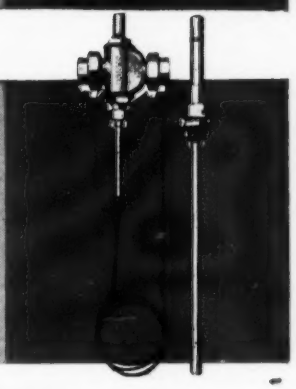




## *Oil Pre-heater*

Temperatures controlled within a degree by Sarco TR-21 temperature controls. No more sputtering—due to improper oil temperatures. Bulletin No. 600.

TR-21



FOUR STARS ON OUR E PENNANT TESTIFY TO SARCO PERFORMANCE IN THE WAR EFFORT

**SARCO** SAVES STEAM

*Represented in Principal Cities*

**SARCO COMPANY, INC., 475 FIFTH AVE., NEW YORK 17, N.Y. • Sarco Canada, Ltd., 85 Richmond St., W., Toronto 1, Ont.**

THE PACKING for EVERY PURPOSE

Stops Leaks— Prevents Scoring

# ALLPAX

This universal packing — consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphite scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc. where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

*Distributors everywhere*

THE ALLPAX CO., INC., MAMARONECK, N. Y.



Hi-Test KEWANEE

FOR POWER and PROCESS STEAM

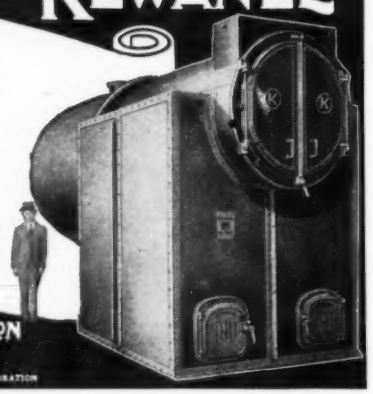
All-welded Portable with refractory lined firebox and fuel-conserving 2-pass tubes. A Q-u-i-c-k Steamer.

6 sizes. 50 to 150 H. P. 125 and 150 pounds W. P.

*75 Years Boilermakers*

WRITE DEPT. 89-K3 for 6" scale with pipe diameter markings.

WON FOR 5th TIME



KEWANEE BOILER CORPORATION

KEWANEE, ILLINOIS

Division of American Radiator & Standard Sanitary Corporation



# ENDURING SERVICE

639

For economy of operation and maintenance; for dependable performance in continuous heavy duty service over long periods, PENNSYLVANIA duplex, direct connected, synchronous motor driven compressors of the type illustrated have earned the endorsement of industry wherever installed.

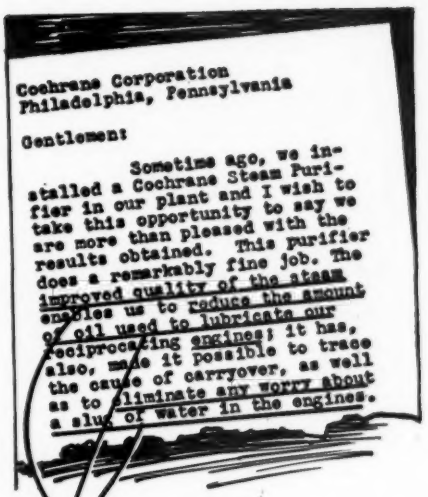
*Please send for descriptive Bulletin No. 192*

PPC

PENNSYLVANIA PUMP & COMPRESSOR CO.

BUSHKILL PARK ROAD, EASTON PENNA





Cochrane Corporation
Philadelphia, Pennsylvania

Gentlemen:

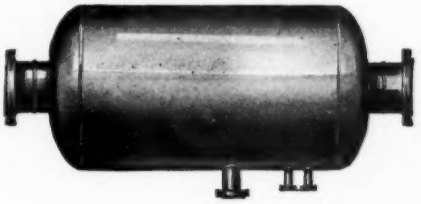
Sometime ago, we installed a Cochrane Steam Purifier in our plant and I wish to take this opportunity to say we are more than pleased with the results obtained. This purifier does a remarkably fine job. The improved quality of the steam enables us to reduce the amount of oil used to lubricate our reciprocating engines; it has, also, made it possible to trace the cause of carryover, as well as to eliminate any worry about a slug of water in the engines.

improved quality of steam

less oil to lubricate engines

eliminates worry over slugs of water in engines.

COCHRANE



# PURIFIER

Results like these have been the experience of thousands of plants where Cochrane Purifiers have been installed. Perhaps your plant could be improved by steam purification.

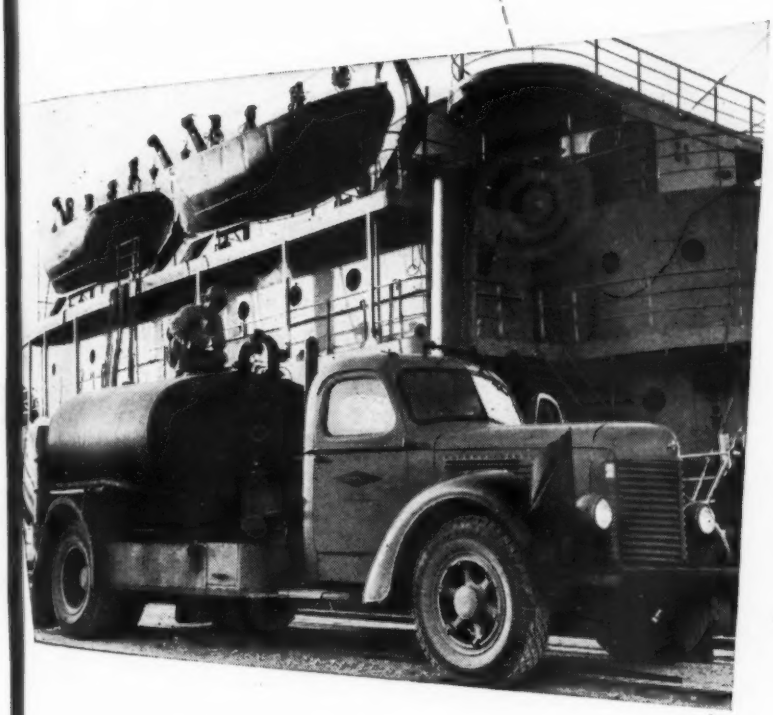
*Write for a copy of Publication 2725*

COCHRANE CORPORATION

3106 N. 17th St., Philadelphia 32, Pa.

# DOWELL

## Dockside chemical cleaning service



**—scale removed**

**—efficiency quickly restored**

Owners, operators and engineers all agree: The *new* ships are *worth* keeping clean and efficient. *So are the older ships.* And—old or new—a clean ship deserves a clean boiler!

Scale and sludge are "stowaways!" Get rid of them!

Dowell's complete dockside service for chemically cleaning your boilers, condensers, water lines and other equipment is the same successful system used in leading industrial plants—and with the same good results.

Dowell specialists inspect your equipment—analyze your scale—and select the proper chemicals to dissolve it. They bring with them adequate equipment and chemical solvents to perform the treatment and to insure effective removal of those unwanted, insulating deposits. They *do* the job—and they do it *right!*

*Call the nearest Dowell office for a free estimate. And ask for your copy of "More Power to America's Industry"—free color booklet which explains Dowell's thorough chemical cleaning service in more detail.*

**DOWELL INCORPORATED**
Subsidiary of The Dow Chemical Company
GENERAL OFFICE: TULSA 3, OKLAHOMA
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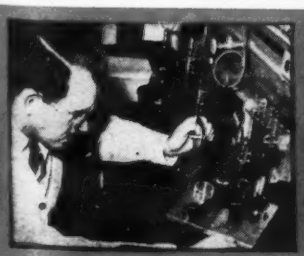
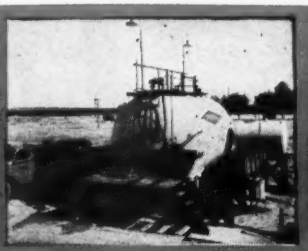
Long Beach, Casper: Dowell Affiliate—International Cementers, Inc.

## SPECIALISTS IN CHEMICAL CLEANING SERVICE



Dowell's experienced industrial engineers are backed by the complete research and technical facilities of The Dow Chemical Company.

Dowell's equipment is modern and complete—scientifically designed. Treating stations and chemical warehouses conveniently located.



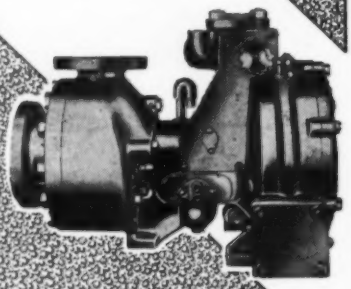
Dowell cleaning solvents are "tailor-made" to fit each job. All ingredients are of the highest quality, chosen for best results in your plant.

DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

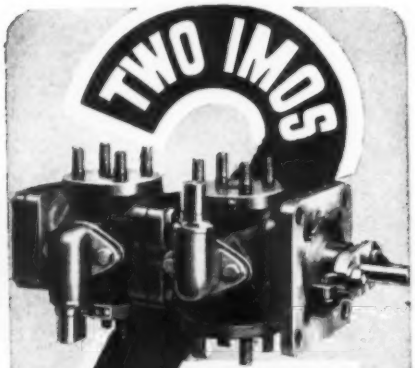
# COFFIN TURBO PUMPS

FOR BOILER FEED AND GENERAL HIGH PRESSURE SERVICE



THE J. S. COFFIN, JR., CO.
ENGLEWOOD NEW JERSEY

# TWO IMOS in One



The COMPACTNESS and arrangement versatility of the IMO pump are illustrated by this tandem mounting of two separate IMO pumps on a common shaft, such as can be used on a Diesel, where one pump is needed for lubricating oil and the other for scavenging oil. Where space is limited, IMOs fit.

*For information send for Catalog 1-122-P*

IMO
PUMP DIVISION OF THE
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY
I MOVE OIL

# YOU CAN'T GET POWER FROM LOST STEAM!

**Steam—or any gas or liquid—leaking past a faulty gland or stuffing box . . . is lost for processing or as a source of power. The *wasted time* and *lost production* resulting from frequent replacement of improper or poor quality packing is a loss of much greater importance! That's why the use of "any packing that's handy" should be guarded against.**

**USE THE *RIGHT* PACKING!**

**PALMETTO makes the *right* packing for every one of your applications . . . the right quality for most economical maintenance . . . the right design for most effective sealing—with least wear to rods, shafts and stems.**

***Write today for bulletins which show what packings to use where.***

**GREENE, TWEED & CO.**
**Bronx Blvd. at 238th St., New York 66, N. Y.**
**Plants at New York, N. Y. and North Wales, Pa.** GT-1526

**PALMETTO** PALMETTO for steam, water, air. PELRO for oils. CUTNO for alkalis. SUPER-CUTNO (blue asbestos) for acids. KLERO for foods.

*Self-Lubricating* **PACKINGS**

# ENGINEERING PROGRESS REPORT # 2

**LJUNGSTROM AIR PREHEATER**

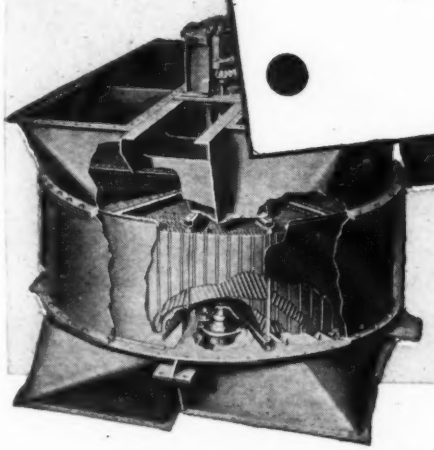
## Economics of Fuel Saving by Lower Exit-Gas Temperatures

Mounting fuel costs stress the importance of savings made by lowering exit-gas temperatures, and thus increasing heat recovery. Problems arising from lower exit-gas temperatures are being given intensive study.

Progress report one covered control of deposits. Encouraging progress is being made toward the reduction of corrosion. At the present time, while it is not possible to eliminate corrosion, it can be held down to a low rate.

This leaves the entire subject of lower exit-gas temperatures on a strict dollars-and-cents basis. With the mass blower in use, increased draft loss caused by the deposits plugging up the heater is no longer a factor.

An exclusive feature of the Ljungstrom air preheater provides for rapid and inexpensive replacement of the elements at the cold end.



**THE**

# AIR PREHEATER

**CORPORATION**

**Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.**

ADAMANT
FIRE BRICK CEMENT

## Its Strength Increases As Temperature Rises

Adamant . . . stronger by test. Impartial laboratory tests showed Adamant has a bonding strength of 800 lbs. at room temperature: 1270 lbs. at 2600° F. Adamant has a P. C. E. of 3000° F. plus.

Lay-up linings with Adamant . . . its higher bonding strength protects the structure at the joints where failure usually begins. Result . . . linings last longer . . . production is maintained . . . repair costs and replacement materials saved. For more details, write.

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782 S. Swanson St., Philadelphia 47, Pa.
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SCHERR
PRECISION INSTRUMENTS
*For Close Reading*

## HAND TACHOMETERS

Measure rpm without timing or calculation while held against end of rotating shaft. Any variation in speed caused by belt slipping, overload, etc., is instantly noted. Also have disc for measuring surface speeds in feet per min. Made for speeds from 30 to 12000 changing speed range by new rotating shift mechanism. Other types to 48,000 rpm. Write for details.

## SPEED INDICATORS

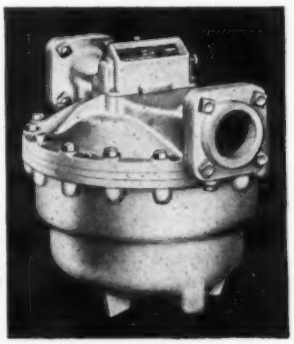
Gives direct readings in rpm in a test requiring only 6 seconds. Needle remains at reading until released by pressure of button. Also measures linear speeds using disc attachment. Two types, ranges to 20,000 rpm. Full data on this and other Scherr speed measuring instruments on request.

GEO. SCHERR CO., Inc.
196-A Lafayette St
New York 12, N. Y.

BOWSER
ESTABLISHED 1885

# WHEREVER LIQUIDS ARE HANDLED.....

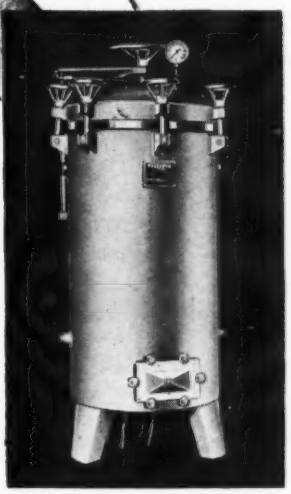
THERE'S A NEED FOR BOWSER EQUIPMENT
. . . for metering, filtering, distilling, pumping, fueling, lubricating, storing or dispensing.



## BOWSER METERS.....

The Bowser Xacto . . . long known as "the world's most widely used meter" . . . is a positive displacement meter of extreme accuracy for recording of liquid transfer operations.

It is made in many standard types and for special applications. In accuracy Xacto Meters exceed all Federal and State requirements.



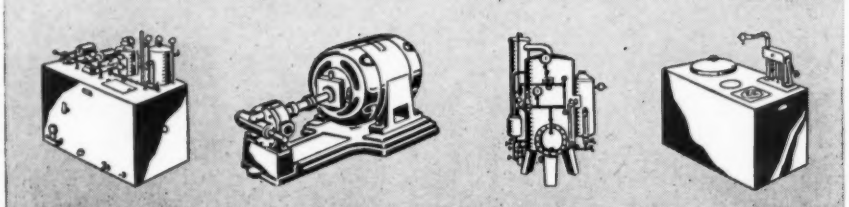
## BOWSER FILTERS.....

The Bowser line of filters covers standard applications in a large group of industries. Monel screen, cloth, cellulose fiber or diatomaceous earth filters are furnished in a wide range of capacities for most liquids.

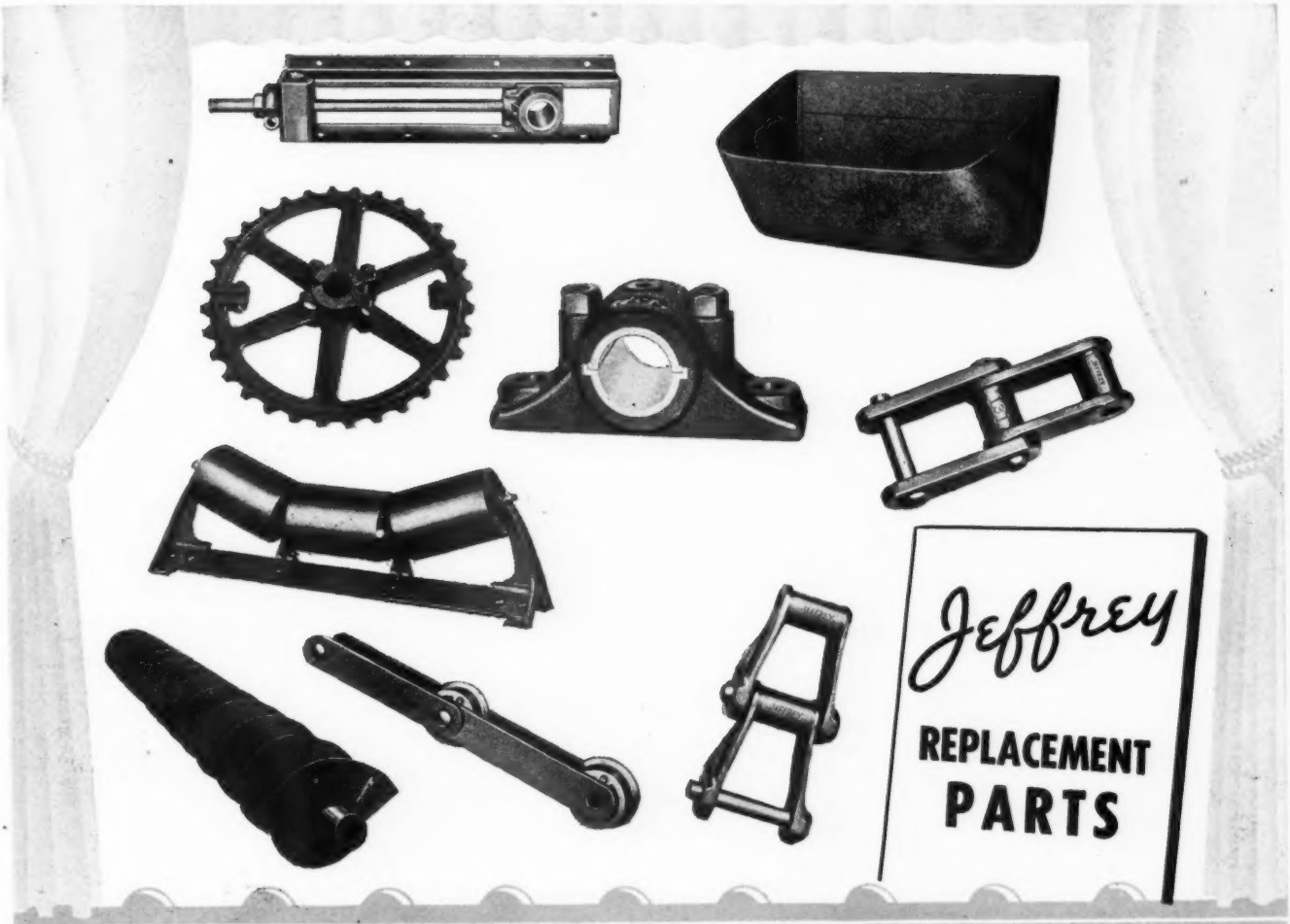
## SALES and SERVICE

The Bowser Sales and Service System makes the Bowser man your next-door neighbor. Your present metering, filtering or other liquid handling problems will receive our prompt attention.
Write Bowser, Inc., 1335 Creighton Avenue, Fort Wayne 2, Indiana.

LIQUID CONTROL SPECIALISTS SINCE 1885



LUBRICATORS | PUMPS | VACUUM STILLS | STORING AND DISPENSING




*Playing an active part in*

EVERY STAGE of PRODUCTION

**Headliners of the conveyor industry. Smooth performance built right into each part . . . the same rules that govern original Jeffrey equipment. Common sense dictates "curtain calls" for Jeffrey parts when replacement becomes necessary. We show just a few . . . more are waiting in the wings.**

**SEND FOR CATALOG NO. 778**

# THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

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Baltimore 1 Buffalo 2 Cleveland 13 Huntington 11 Milwaukee 11 Pittsburgh 22
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Boston 16 Cincinnati 2 Detroit 13 Huntington 19 Philadelphia 3 Salt Lake City 1
Scranton 3

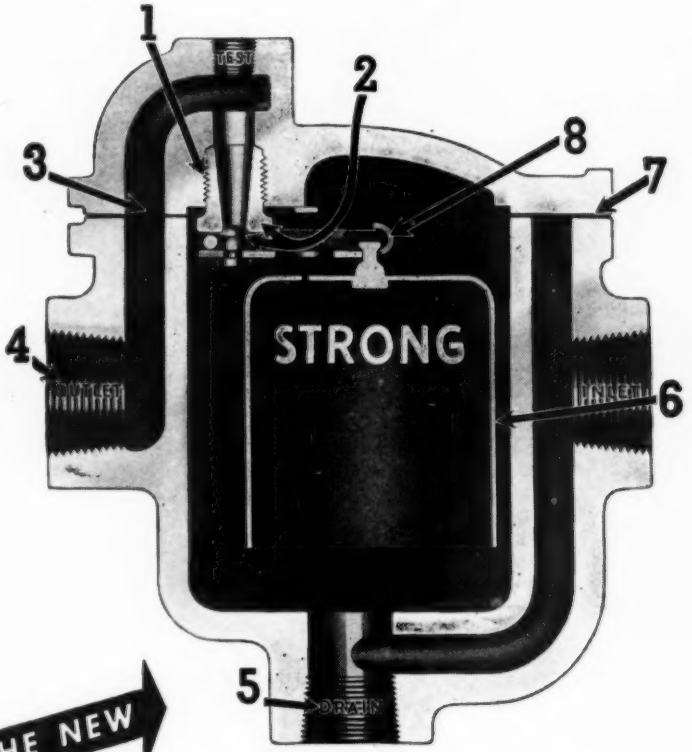
# *Eight Improvements*

## GENUINE make STRONG 70 Series Traps Better than Ever!

*Look at these new features:*

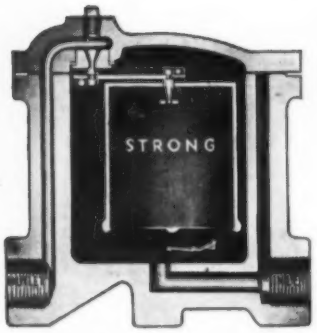
1. Renewable seat replacing pressed-in design;
2. Anum-Metl* valve and seat with new scientifically designed Hi-Cap* (patent applied for) orifice . . . up to 25% greater capacity;
3. Oversize inlet and outlet ports—increased flow capacity;
4. Relocated inlet and outlet connections—avoids backflow on light loads;
5. Drain connection added—available for bottom inlet;
6. One-piece, deep-drawn, stainless bucket—no welds;
7. Larger gasket area—means positive seal;
8. New, improved, stainless, high-ratio leverage.

***Plus*** Adaptability to older models with change-over assembly including Hi-Cap orifice.




New 70 Series Strong Trap, No. 170

COMPARE THE NEW WITH THE OLD




Old 70 Series Strong Trap

In improving the 70 Series trap, Strong has remembered the thousands of older style 70 Series traps still in service after many years. Each improvement bears the "proof in service" label, so Strong quality remains uniformly high. Service continues to be available on all Strong traps, and they can be completely modernized to include the improvements listed above.

With a complete line of Strong open and inverted bucket traps at their disposal, Strong engineers can specify exactly the right type of trap for your particular application. For full details, write for the new Strong Catalog No. 67.

**STRONG, CARLISLE & HAMMOND COMPANY, Cleveland 13, Ohio**

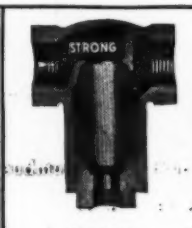
*Registered Trade Mark

REG. TRADE MARK

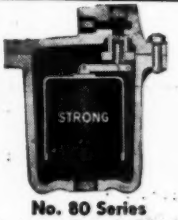
OTHER ANUM-METL Reg. Trade Mark

# STRONG

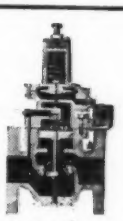
STEAM SPECIALTIES



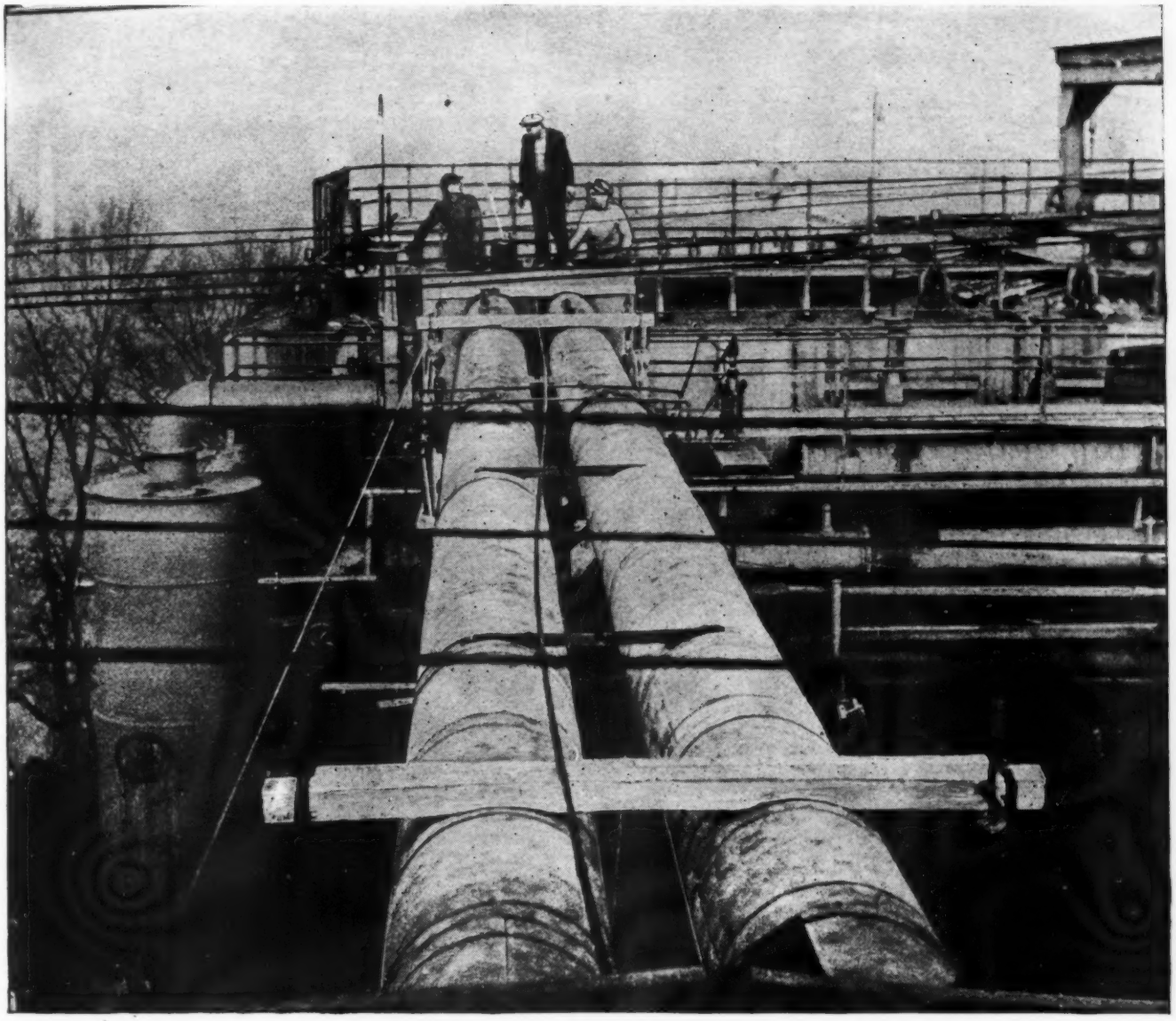

Strainer




No. 80 Series Trap



Reducing Valve



# HOW FIBERGLAS* BEAT THE WEATHERMAN

Predictions of "continued cold" can mean serious trouble—unless pipes are adequately insulated. Fiberglas Industrial Insulation, furnished in forms to meet every interior and exterior requirement, is helping industry avoid the costly effects of weather changes and extremes.

During a natural gas shortage, a West Virginia concern built its own gas-producing unit. Efficient operation was aided by the application of Fiberglas insulating blankets, pipe covering and insulating cement. Moisture condensation in two 18-inch gas lines, which had caused severe pressure drops, was eliminated by insulating more than a mile of lines with Fiberglas pipe insulation. And this same highly efficient thermal insulation, installed on outside water lines, prevented freezing.

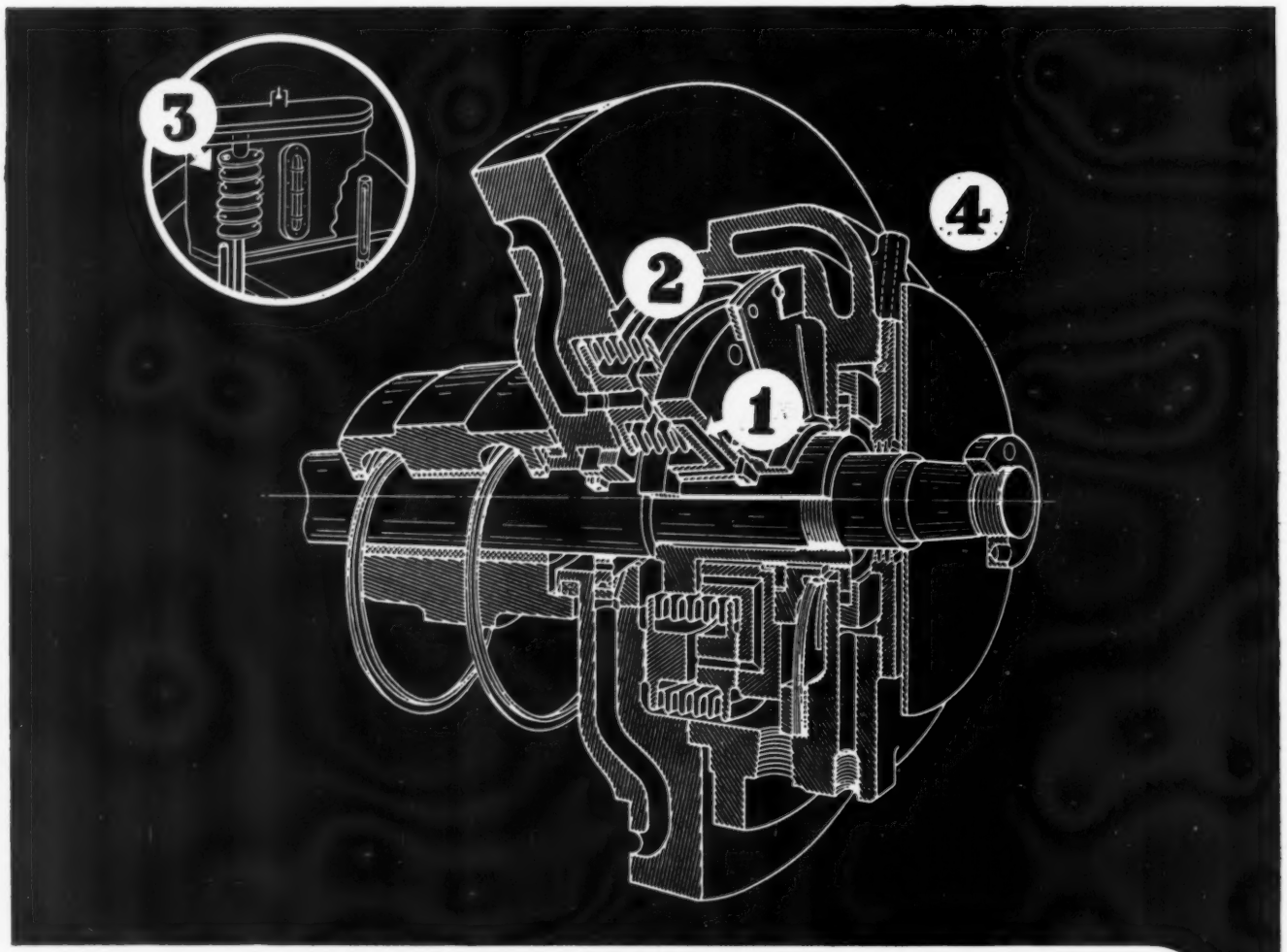
The illustrated booklet, "Fiberglas Insulations for Industry", will give you complete information about all of the forms of Fiberglas Industrial Insulation materials. Write for your copy today. Find out how this better material can help you "beat the weatherman" and save money. *Owens-Corning Fiberglas Corporation, 2000 Nicholas Bldg., Toledo 1, Ohio.*

*In Canada, Fiberglas Canada Limited., Oshawa, Ontario.*

# FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

OTHER FIBERGLAS PRODUCTS: ELECTRICAL INSULATION MATERIALS  DUST-STOP* AIR FILTERS  FIBERGLAS YARNS AND CLOTHS  FIBROUS GLASS MATS




# The Centrifugal with the Dollar-saving Seal

The centrifugal refrigerating machine pioneered by Carrier has the money-saving advantages of a positive, simple, fully automatic seal *without surface contact* while in operation This seal—of revolutionary Carrier design—saves thousands of dollars in refrigerant losses . . . reduces corrosion and power loss by keeping out moisture and air.

The passage of refrigerant and air along the high-speed shaft is prevented by a pressure oil film. This oil holds the seal faces apart when the compressor is operating, making metal-to-metal contact impossible. By the elimination of surface wear the seal is assured long life and perfect adjustment. Maintenance costs are kept at a minimum.

The dollar-saving Carrier seal—like the centrifugal itself—is the product of the most experienced engineering staff in the whole field of air conditioning and refrigeration. You can count on Carrier centrifugal refrigeration units. They're designed and built to deliver years of uninterrupted service. That's been proved by 25 years' successful operation. Carrier Corporation, Syracuse, N. Y.

**Carrier**

**AIR CONDITIONING**
**REFRIGERATION**
**INDUSTRIAL HEATING**

(1) Oil under pressure forces seal faces apart when compressor is operating. This forms an effective seal against loss of refrigerant and admission of air and water, prevents wear due to metal-to-metal contact. Thin oil film is maintained between stationary and rotating seal face during shutdown periods.

(2) Fatigue of metal bellows is overcome by design of seal. Bellows move to a fixed position when compressor is starting or stopping and are not subject to the movements of shaft and rotating seal faces.

(3) Seal is supplied continuously with clean oil. Both strainer and cloth filter remove all impurities, extending seal life.

(4) Inspection of seal is fast and simple. Access to it is by removing six nuts.

# BETTER THAN EVER!

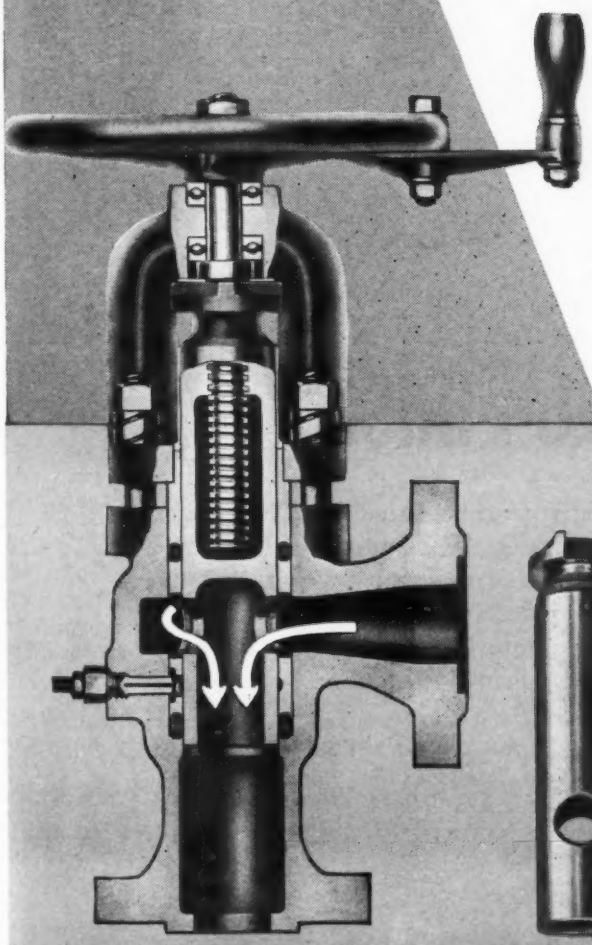
Constant metallurgical and mechanical research—aimed solely at improving boiler blowdown service—have made today's Yarway Seatless Blow-Off Valves literally "better than ever."

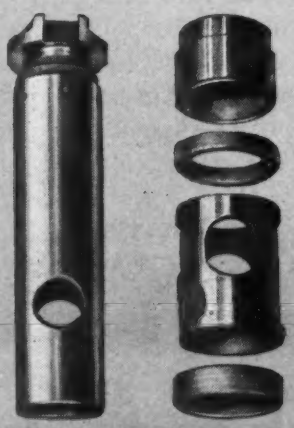
From the Yarway Research Laboratory have come such basic improvements as nitrided nitralloy sliding plungers and Neoprene-type packing rings. Both greatly increase the service life of Yarway valves . . . make them even more of a favorite among the nation's power plant operators.

The Yarway Seatless Blow-Off Valve has been hailed since its introduction because it eliminates a source of continuous trouble. It has no seat to score, wear and clog with mud, scale and dirt. Today it is "standard" in more than 12,000 plants.

Ask for Bulletin B-424 for pressures to 400 psi.; Bulletin B-432 for higher pressures.

**YARNALL-WARING COMPANY**
**100 Mermaid Ave., Philadelphia 18, Pa.**





**SEE YARWAY BLOW-OFF VALVES ...HEAR LOWELL THOMAS** describe their design and application in the new 30-minute color and sound motion picture "There Is An Engineering Reason." Free for group showings. Write for details.

**YARWAY BLOW-OFF VALVES**

Illustration shows GARLOCK 234 Braided Asbestos Packing in Coil form. GARLOCK 244—Coil with wire. GARLOCK 239—Rings. GARLOCK 249—Rings with wire.

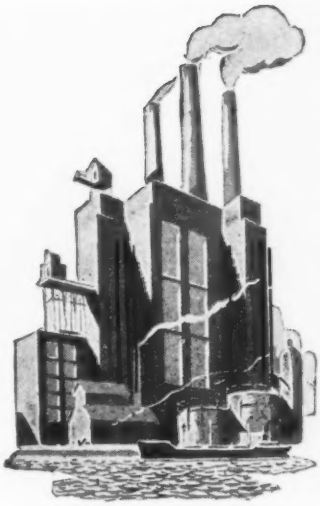
# QUALITY *Controlled*

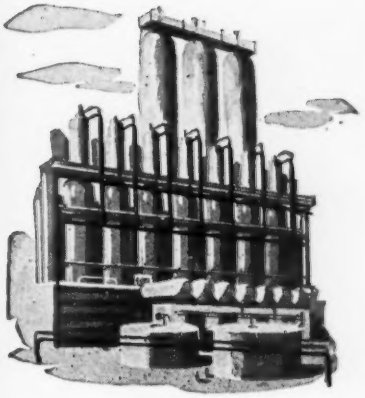
## from Start to Finish

**Garlock 234** Packing is manufactured from raw material to finished product in the Garlock factory. *Quality is controlled* from start to finish. Like other Garlock products, 234 is uniform and can be depended on—for long, economical service. Use GARLOCK 234 on rotary or centrifugal pumps handling hot water, cold water, caustic solutions or weak acids.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

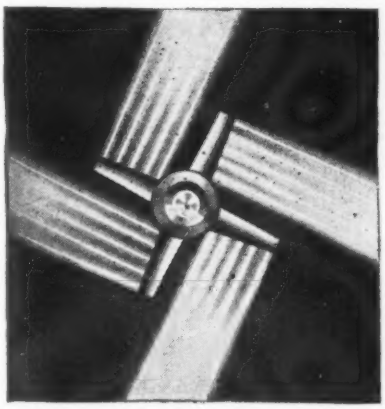
# GARLOCK





# "PINWHEEL ACTION" BURNER

## INCREASES BOILER RATINGS



### Coppus-Dennis FANMIX Uses New Principle to Create "Flameless Fire" and Get More Heat from Gas or Oil

Greater heat release results from the unique Dennis principle of combining fuel with air in a perfect mixture to provide truly radiant heat — "flameless fire".

On natural gas, for example, FANMIX provides complete combustion with less than 5% excess air in the product of combustion leaving the furnace.

Increase ratings of equipment now operating at limit of present burners. Install FANMIX . . . easily, economically . . . and get more heat.

Coppus engineers FANMIX Burners for individual applications. Complete control over rate of combustion or "flame pattern" can be provided to meet the requirements of any installation. Coppus Engineering Corporation, 403 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

### "Pinwheel Action" Gives Perfect Proportioning

Fuel escaping from orifices in rotating driver arms, rotates the fan, which draws in air at right angles to the path of the fuel. The energy in the fuel under pressure is utilized to perform work by mechanically mixing and proportioning the fuel automatically with just the required amount of air.

This homogeneous mixing secures complete combustion. Uniform temperature conditions exist throughout the furnace, with complete absence of drifting "hot spots".

### New Installations — FANMIX Cuts Investment Cost

Smaller combustion space — furnace is relieved of having to serve as mixing chamber. Less stack — FANMIX creates its own forced draft, overcoming draft loss across the burner. No forced draft equipment — FANMIX draws air for combustion through air-cooled walls or floors.

### 2 Types — Straight Gas or Combination Gas-Oil

Combination burners burn either oil or gas in entirety or in any proportion. No oil guns needed.

ANOTHER

**COPPUS**

"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
403 Park Ave.,
Worcester 2, Mass.

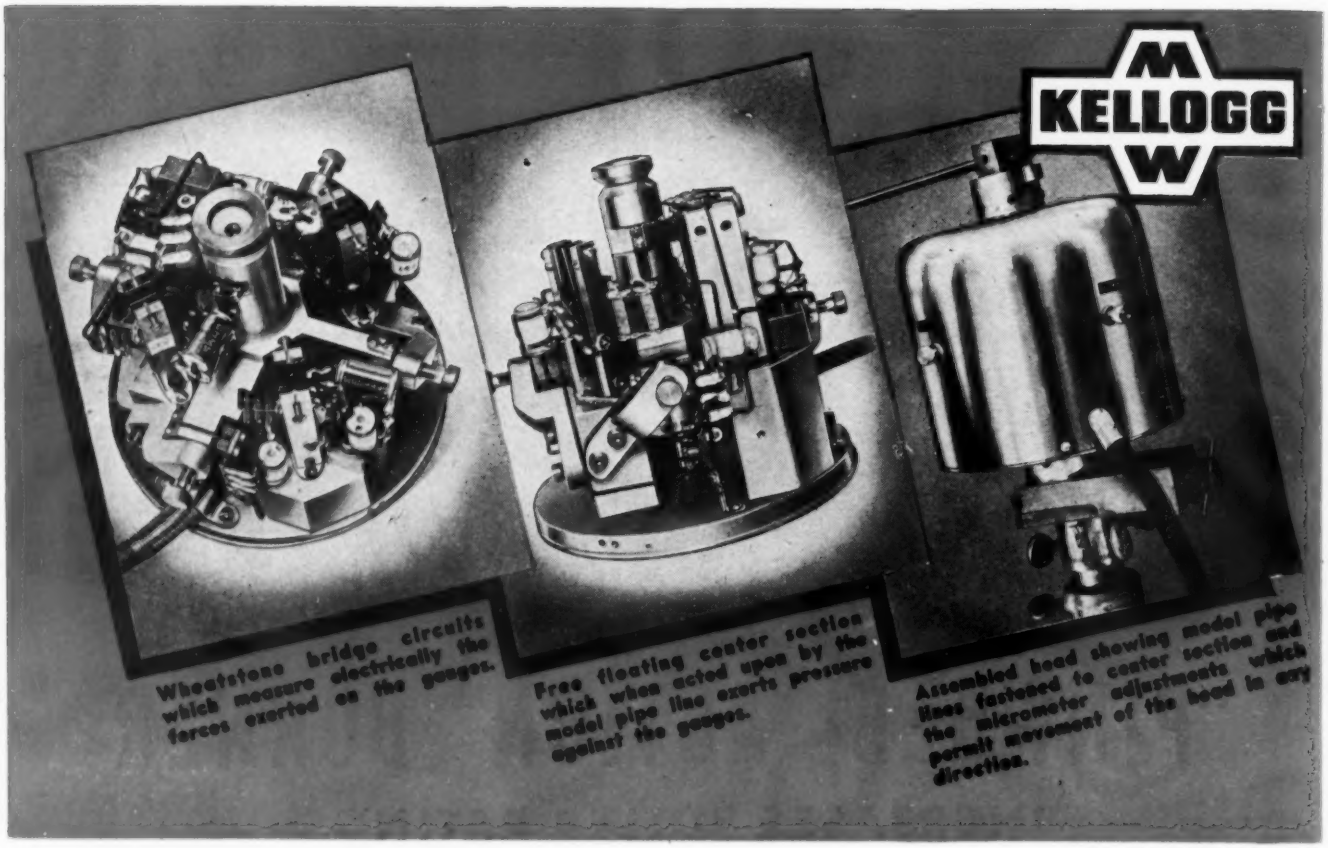
Please send me Bulletin 410-4

*New Bulletin Will Tell You How to Increase Thru-Put of Your Gas- or Gas-Oil Fired Equipment.*

Name.....

Company.....

Address.....


KELLOGG
Wheatstone bridge circuits which measure electrically the forces exerted on the gauges.
Free floating center section which when acted upon by the model pipe line exerts pressure against the gauges.
Assembled head showing model pipe lines fastened to center section and the micrometer adjustments which permit movement of the head in any direction.

# These Heads Measure Load Deflections to ONE-MILLIONTH of an INCH

**These super-sensitive instruments were designed and are used exclusively in the Kellogg Engineering Department for the benefit of Kellogg piping clients.**

**By using the Kellogg model testing apparatus, the most complicated design problems of high pressure, high temperature piping assemblies are solved accurately and quickly.**

**The "bugs" are found and eliminated before the final drawings go to the shop. This design research service is available to consulting, power, process and marine engineers.**

**A new bulletin "Analyzing Piping Stresses by Tests of Models" has just been issued. Write today for your copy.**

KELLOGG

"Masterflex" Prefabricated Piping Systems "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

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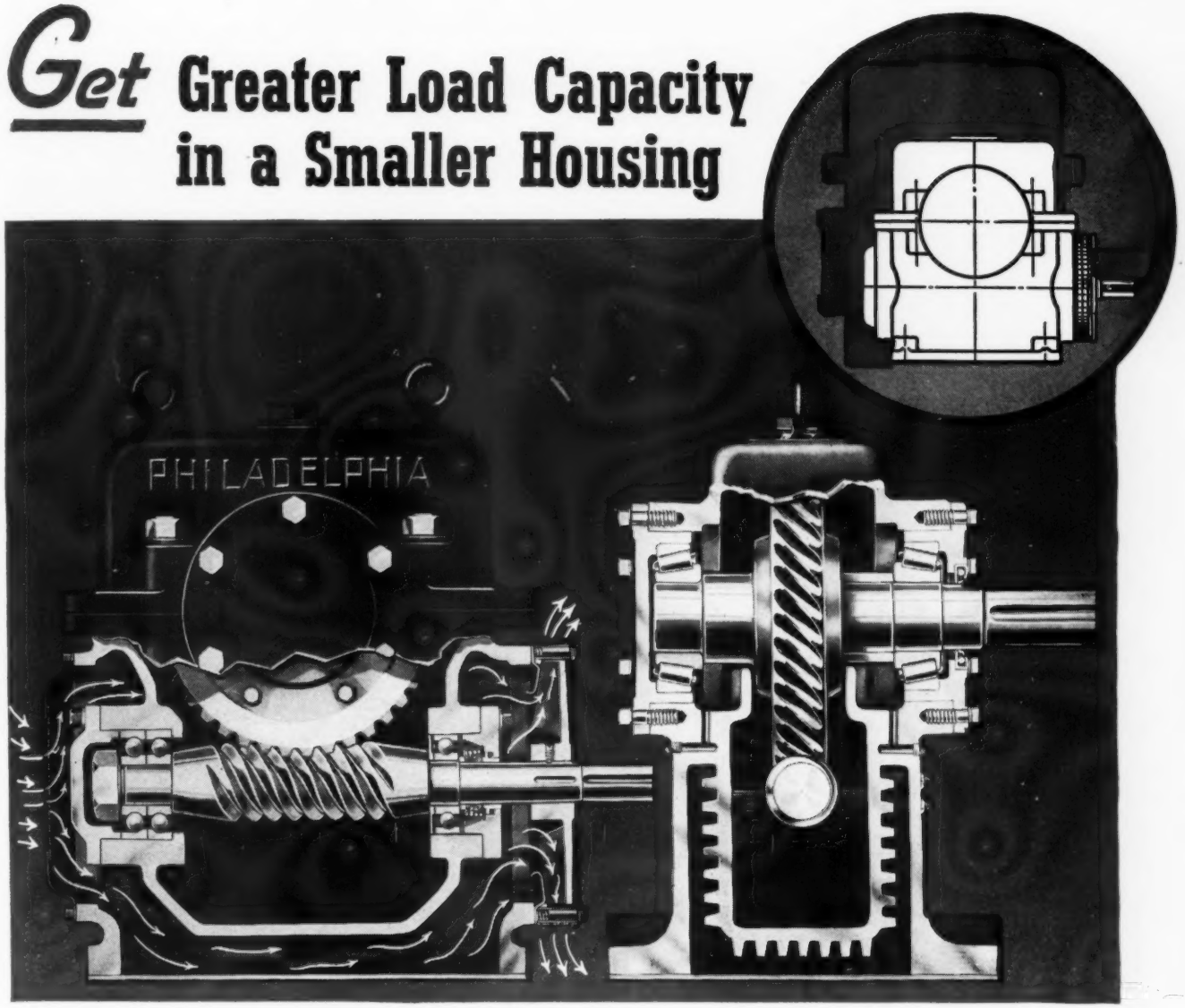
# *Get* Greater Load Capacity in a Smaller Housing




## ...with the Philadelphia AIR KOOLED Worm Gear Speed Reducer

At the upper right is shown the comparative sizes of a size 675 Type AT standard unit (in blue) and a size 475 AirKooled unit. Both deliver 20 HP at 1750 RPM. Ratio 4 6/7 to 1.

The cut-away drawings show the double-walled, finned housing and the flow of air around the oil reservoir.

Considerable *space* and *weight* savings have been made possible by the design of Philadelphia AirKooled Worm Gear Reducers as compared with standard heavy duty type worm gear units.

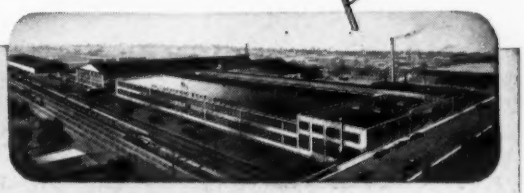
The AirKooled design features a suction fan, mounted on the worm shaft, which draws air through the double-walled, finned housing. This dissipates generated heat, and thereby maintains a higher contact oil film strength and greatly increases the horsepower ratings at worm speeds of 580 and 1750 RPM. For all ratios at 1750 RPM the ratings are approximately doubled, so the AirKooled unit is about two sizes smaller than a standard unit of the same capacity.

Let us tell you what these savings can mean to you.

**SEND FOR BULLETIN 250 .... *on your Business Letterhead***

**Philadelphia GEAR WORKS INCORPORATED**

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO
IN CANADA: WILLIAM & J. G. GREEY LIMITED, TORONTO.



***Industrial Gears and Speed Reducers***
***LimiTorque Valve Controls***

# THIS *REVOLUTIONARY* SAFETY VALVE

## *NEW* IS NOW AVAILABLE TO INDUSTRY!

Foster Type 38-SV Super-Jet Safety Valve for pressures from 400 to 3000 pounds at temperatures up to 1000° F.

More than 6 years ago the Foster 38-SV Safety Valve was developed especially to meet the trend toward higher operating pressures and temperatures.

The problem was approached with a thorough understanding of the factors involved — *plus* — a good healthy dissatisfaction with the shortcomings and limitations of conventional safety valves. As a result, the design of the new Foster 38-SV is revolutionary and its performance characteristics are phenomenal.

**A few of the advances: constant popping point regardless of changes in temperature; full opening practically instantaneous with less than ½% accumulation; tight closing as little as 1% below popping point; blow-down adjustable as low as 1%.**

Since the first installation early in 1940, more than 100 Foster 38-SV Safety Valves have been working at pressures up to 2575 pounds and at temperatures up to 1000° F. And during the war, all we could make went into installations vital to the war effort.

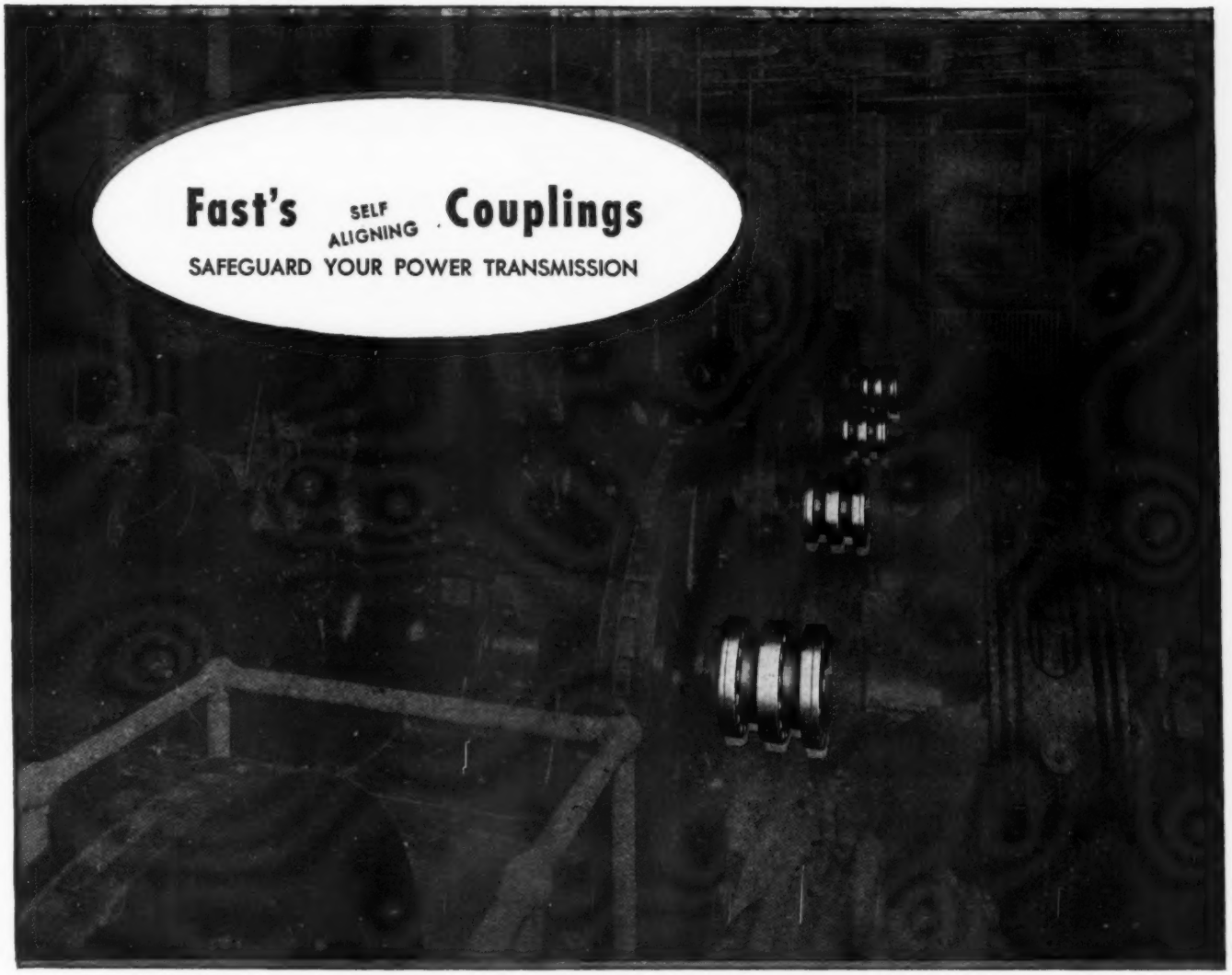
**NOTE:**

Now Foster 38-SV Safety Valves are available to Industry again, and Bulletin 25, describing them, will be sent promptly on request.

# FOSTER ENGINEERING *Company*

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

**106 MONROE STREET • NEWARK 1, N. J.**




# 145,000 hours of operation

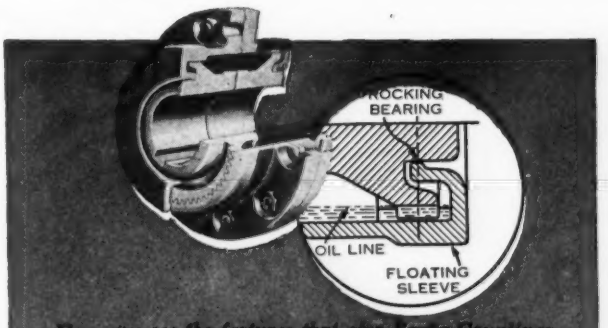
## WITH NO DELAYS—OR EXPENSE!

When you buy couplings, you want unquestioned dependability, and there's no better guide in selection than performance on actual jobs.

You can find plenty of evidence like this to support the choice of "Fast's." Here's an example from the Western Maryland Dairy Company plant at Baltimore.

No. 5 Fast's Couplings were installed on a battery of 60-HP motor-driven ammonia compressors in 1922. The equipment operates 24 hours a day from June through September and 18 hours a day the balance of the year. The couplings are still on the original machines, and Mr. C. Guethler, the engineer, states that "they never have given a moment's trouble, and were never taken apart except when it was necessary to work on the connected machines."

If that's the kind of *service* you're looking for, "Fast's" are the *couplings* you're looking for. Their exclusive design features give exclusive service qualities that safeguard your power transmission. Ask for a catalog.




*Here you see the features that give Fast's Couplings their remarkable dependability. All parts are protected from wear by a positive film of oil. Oil purity is guarded by rocking bearings, located in the one position where they maintain a positive metal-to-metal seal. There are no perishable parts in "Fast's."*

**KOPPERS COMPANY, INC.** BARTLETT HAYWARD DIVISION
BALTIMORE, MARYLAND

**KOPPERS**
THE INDUSTRY THAT SERVES ALL INDUSTRY

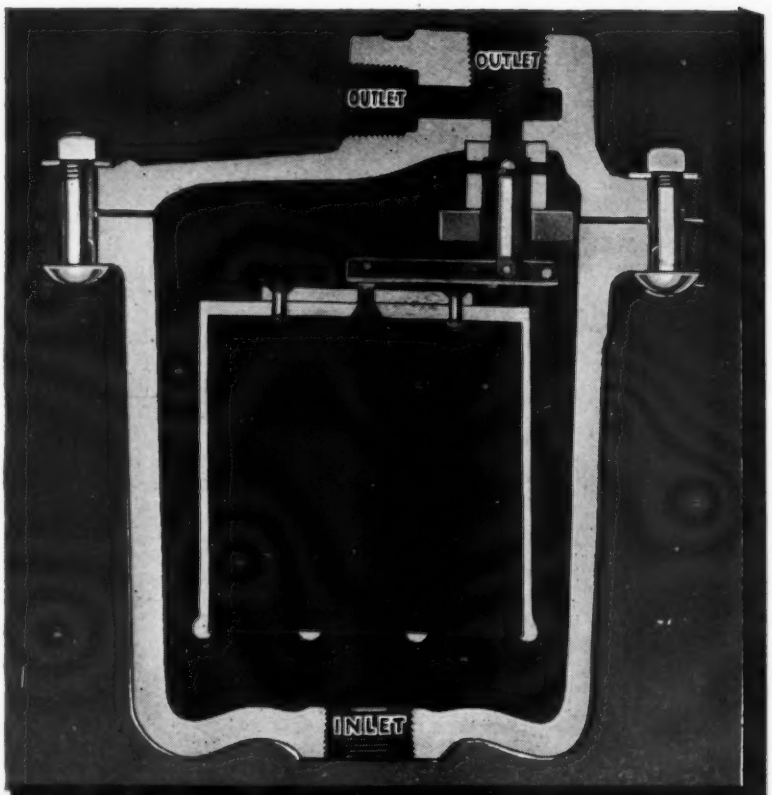
# 37 Years •

Makers of steam traps and other fluid controls have for many, many years helped practically every industry improve efficiency and reduce costs wherever steam, air or gas are used.

**37 Years** of design leadership...

**37 Years** of precision manufacturing..

**37 Years** of proved performance are behind the reputation of Clark Fluid Controls for always meeting or exceeding claims made for them.




The popular CLARK SERIES 80 Inverted Bucket Type Steam Traps with Clark Patented Bucket Venting Device and other exclusive Clark features. Available in 6 sizes, ½" to 2½", for pressures up to 250 P.S.I. and temperatures to 450° F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

# Clark
## FLUID CONTROLS

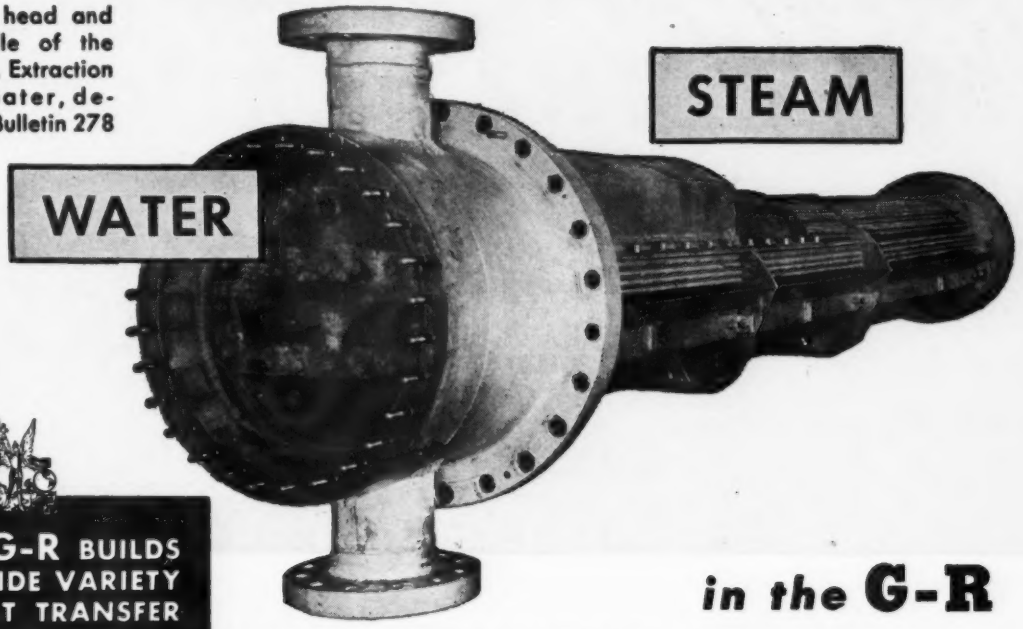
**THE CLARK MANUFACTURING COMPANY • DEPT. A • CLEVELAND 14, OHIO**

***Makers of a wide line of fluid controls including***

| | | |
|---|---|---|
| STEAM AND FLUID TRAPS | STRAINERS | PRESSURE REGULATORS |
| VACUUM AND LIFTING TRAPS | VALVES | REDUCING VALVES |

# MOST EFFICIENT USE OF...

Stationary head and tube bundle of the G-R Type L Extraction Steam Heater, described in Bulletin 278



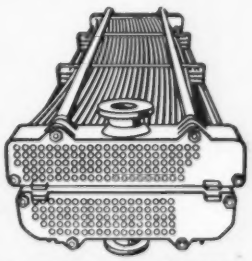

ONLY G-R BUILDS THIS WIDE VARIETY OF HEAT TRANSFER APPARATUS

## *in the* G-R EXTRACTION STEAM HEATER

**SHELL and BARE TUBE**
Heaters, Coolers, Condensers, Heat Exchangers

**G-FIN**
Longitudinal-finned elements for greater heat conductivity

**K-FIN**
Helical-finned elements for vapors and gases



**BENTUBE EVAPORATOR**
Scale-shedding Elements

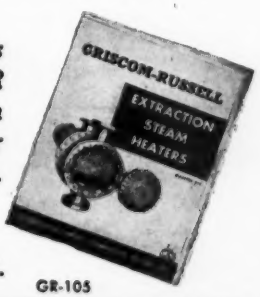
**TUBEFLO SECTIONS**
Non-clogging design for residuum and other dirty fluids

Seventy-eight years of specialization and pioneering in the development of heat transfer apparatus have made the G-R Extraction Steam Heater far more than merely a bundle of tubes in a shell. For example:

**STEAM** is properly distributed above and around the heating surface of all G-R Heaters by a steam impact baffle. This baffle also guides the steam properly throughout the entire tube bundle, and protects the tubes from erosion, vibration or chafing. In low pressure heaters, large steam distributing domes are provided, and when the heater is to operate with highly superheated steam, a patented enveloping baffle permits cross-over temperatures and protects the shell from high temperatures.

**WATER** is prevented from leaking between passes by patented partition pass plates which do not require staybolts. High pressure heaters have heads with visible pressure seal, and do not require the large number of heavy bolts which are necessary in other high pressure designs.

*These features, together with many others which distinguish the various types of G-R Extraction Steam Heaters, are described in Bulletin 278 which every plant engineer should have. Your copy sent on request.*




**THE GRISCOM-RUSSELL CO.**
285 Madison Ave. New York 17, N. Y.

GR-105

# GRISCOM-RUSSELL

*Pioneers in Heat Transfer Apparatus*

# An Opportunity THAT KNOCKS ON BOILER ROOM DOORS

**WITH ASSURANCE OF**

**Less Fuel Costs**
**Larger Boiler Capacity**
**Savings in Maintenance**

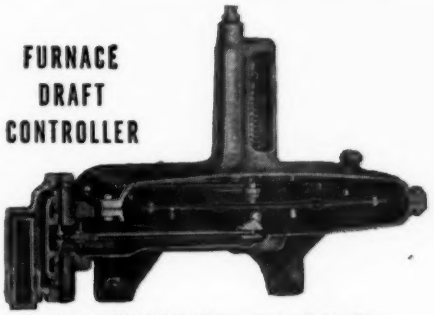
## CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

• CASH STANDARD instruments maintain the proper proportion of air supply continuously so that you get continuously effective combustion . . . where such controlled combustion exists, there is no under-firing to cut steam supply nor over-firing to waste fuel. Through the proper operation of the stack damper, heat is not absorbed by excessive air above the fire and thereby lost through the stack . . . the heat goes direct to the boiler water to give you more steam.

CASH STANDARD Units, available in a number of variations, can be combined to make a most accurate and dependable Automatic Combustion Control System to meet any condition and work on any boiler or stoker with any kind of fuel.

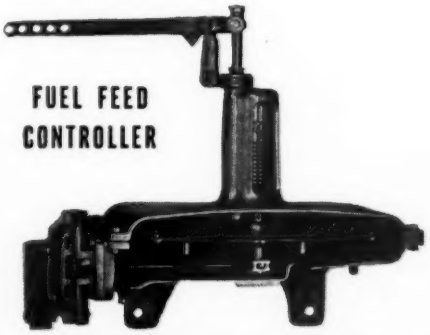
*Write today for Bulletin No. 300*

FURNACE DRAFT CONTROLLER



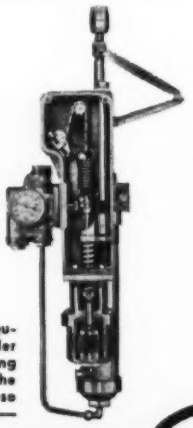
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from over-fire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

FUEL FEED CONTROLLER



This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

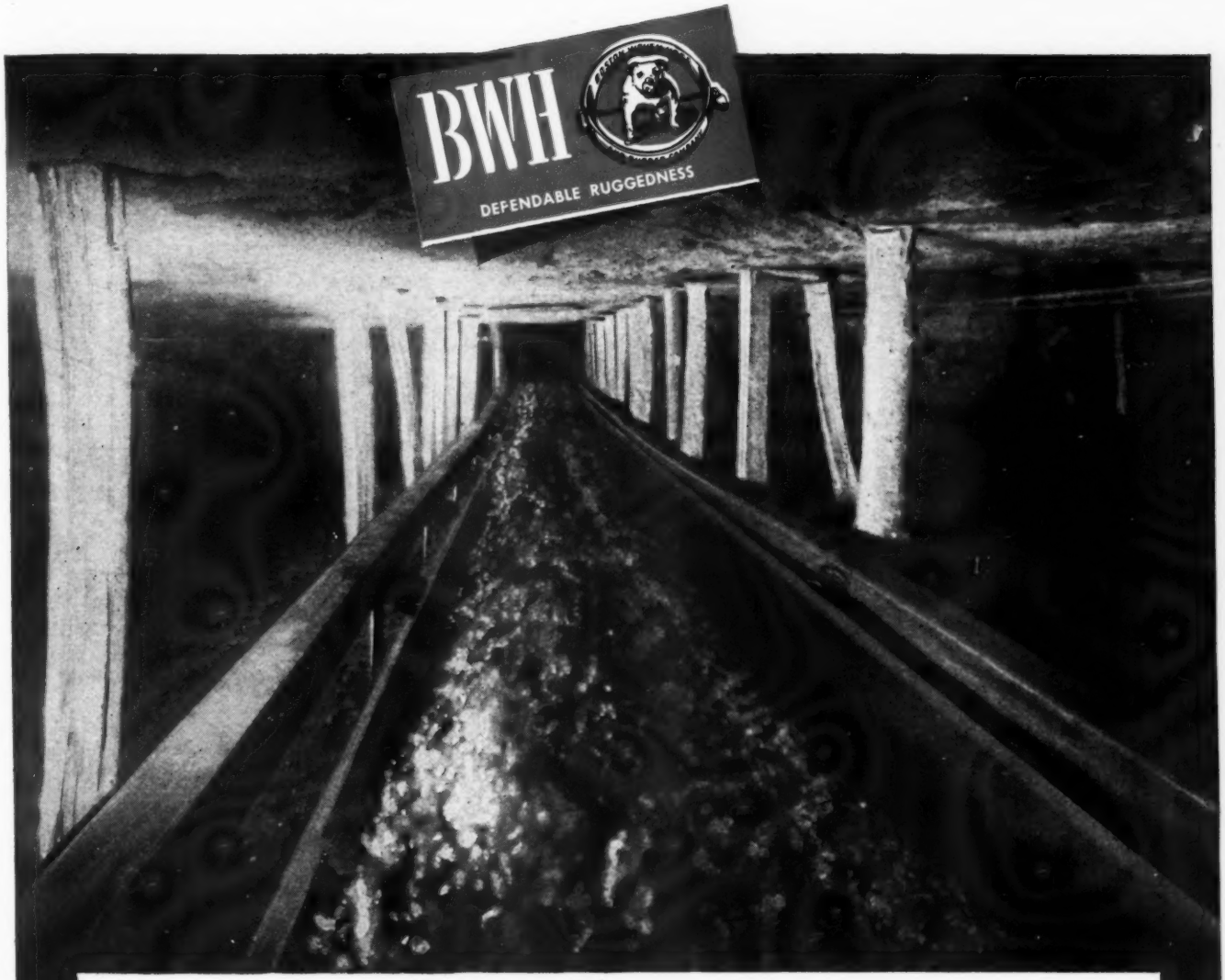
AIR FLOW CONTROLLER



This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion—hence, money saving.

**A. W. CASH COMPANY**
DECATUR, ILLINOIS

**CASH STANDARD CONTROLS . . VALVES**




TOUGH LOADS . . . RIGHT ANGLE FEED . . .

# LICKED BY BWH CONVEYOR BELT!

Far below ground, a BWH Conveyor Belt, under extremely difficult conditions, licked the problems posed by this Pennsylvania Coal mining operation. Used as a "gathering conveyor," it picked up the discharge from other room conveyors and brought the coal to the cars. This operation involved tandem drive, right angle feed, and uneven distribution of load. Yet this belt . . . produced by the exclusive BWH ROTOCURE process of continuous vulcanization . . . did the job, and did it well!

This "know how" in producing conveyor belts of extraordinary toughness is one reason why BWH is known throughout industry for its achievements in producing industrial rubber goods of dependable ruggedness. Perhaps you've a problem we can solve for you.

HAVE YOU A JOB WHERE STAMINA COUNTS?

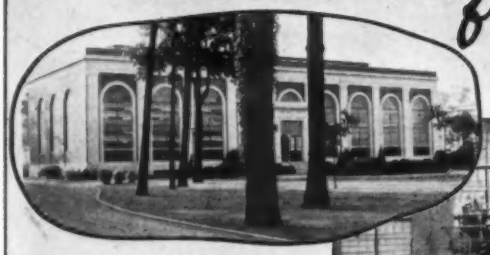
**Bring us your toughest problems . . . we're specialists in solving them. Consult your nearest BWH distributor, or write to BWH direct.**

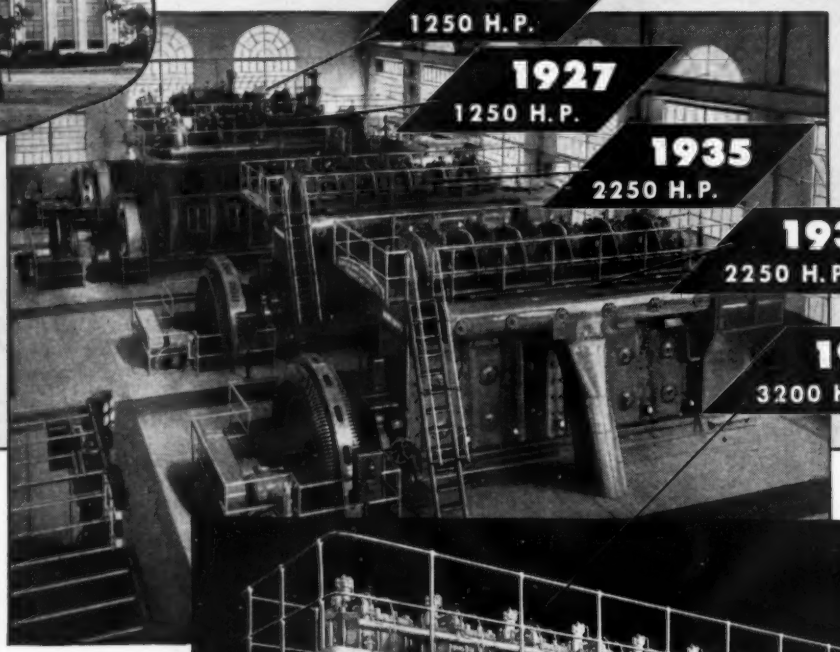
## BOSTON WOVEN HOSE & RUBBER COMPANY

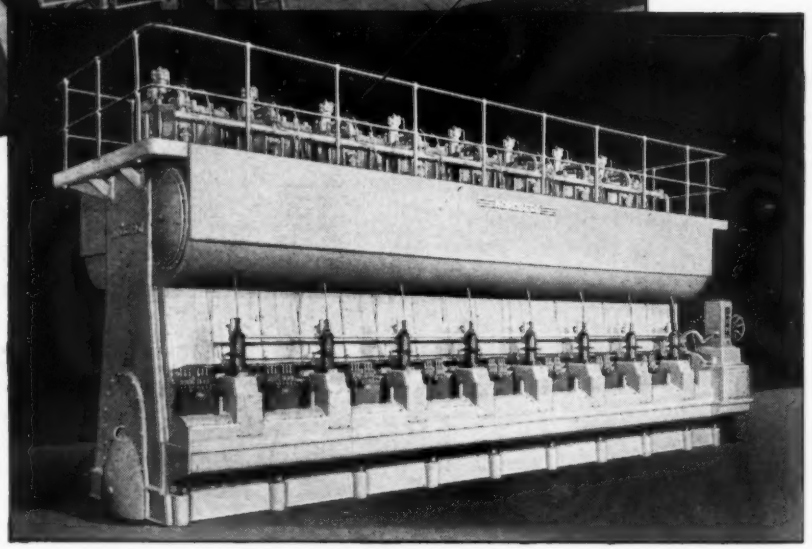
Distributors in All Principal Cities

**WORKS: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.**

# The 5th NORDBERG REPEAT ORDER *from* CARTHAGE, MISSOURI





WITH the latest addition of a 3200 horsepower Nordberg Diesel generating unit, the Carthage municipal power plant will have a total capacity of 10,200 horsepower in Nordberg Diesels, making it one of the larger Diesel powered utilities in the country. The first Nordberg Diesel at Carthage was of 750 horsepower purchased in 1920. In 1923 and again in 1927, units of 1250 horsepower were added. With the need for additional generating capacity in 1935, the original 750 horsepower unit was replaced with a 2250 horsepower engine. Then in 1937 another Nordberg Diesel of this same size, was added, and now the fifth engine, one of 3200 horsepower. These repeat orders from Carthage and from other of the nation's outstanding Diesel engined power plants is evidence of the many satisfied Nordberg users and the successful performance given by these engines. If you need additional generating capacity or are interested in obtaining power at lower cost, investigate Nordberg Diesel power

**NORDBERG MFG. CO. • MILWAUKEE 7, WIS.**

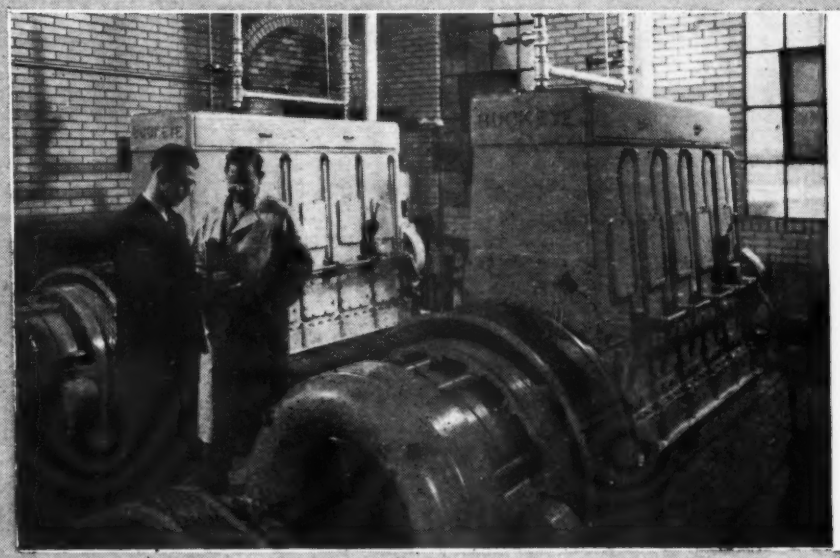
**NORDBERG**
**DIESEL ENGINES**

"With

# Gulf Parvis Oil

## we doubled the time between overhauls, reduced maintenance costs"—

says this Chief Engineer



Actual photo of Chief Engineer (right) consulting with a Gulf Service Engineer on Diesel engine lubrication.

"GULF PARVIS OIL has proved far superior to other oils we have used to lubricate our Diesels," says this Chief Engineer. "Before we put Gulf Parvis Oil in service, we found it necessary to overhaul each unit every year. Now we have less sludge and valve deposits, and are able to avoid overhauls for over two years."

There are good reasons for the outstanding service record of Gulf Parvis Oil in hundreds of industrial and marine Diesels: This quality oil has higher lubricating value for more effective protection—greater resistance to oxidation for longer lasting protection—and is nonfoaming. Each of these features will provide better lubrication for your Diesels!

Gulf Parvis Oil is available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Call in a Gulf Service Engineer and ask him to recommend the proper grade to fit your particular requirements. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

**Gulf Oil Corporation · Gulf Refining Company**

*Division Sales Offices:*

**Boston · New York · Philadelphia · Pittsburgh · Atlanta**
**New Orleans · Houston · Louisville · Toledo**

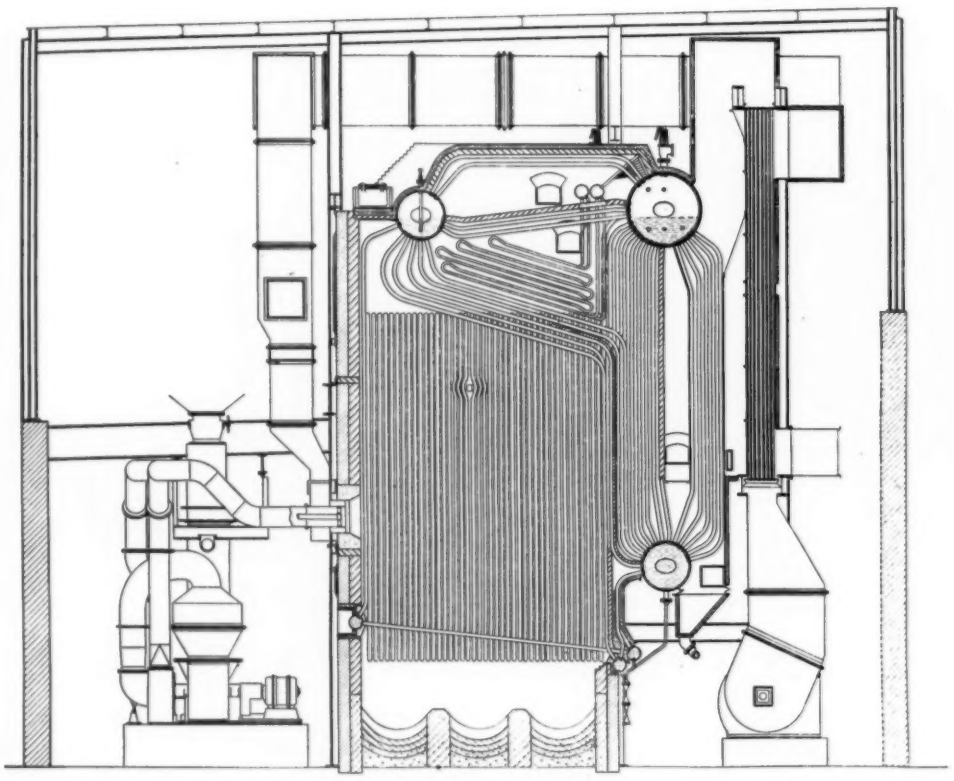
# EDGE MOOR
## RADIANT HEAT BOILER

**Edge Moor** Radiant unit design embodies all the advantages of a 3-drum boiler with a water cooled furnace and maximum boiler tube surface exposed to radiant heat, all in a minimum of space.

This arrangement provides for large water storage, a generous steam liberation surface and a quiet offtake drum. Furnace cooling is disposed for a minimum of maintenance requirements and the best operation for the particular fuel to be burned.

The ability of the Edge Moor Radiant Heat Boiler to steam quickly and to deliver continuous high ratings is a matter of record. It is available in all sizes and pressures, and is adaptable to all fuels.

EDGE MOOR IRON WORKS, Inc., Main Office and Works, Edge Moor, Del. Branch offices: New York 1, N. Y., Empire State Building; Chicago 2, Ill., One No. LaSalle Street.



Edge Moor radiant heat unit arranged for pulverized coal or liquid fuel firing. Equipped with superheater and Edge Moor verfical tubular air preheater.

**EDGE MOOR**

*steam generating equipment*

# THIS LABYRINTH

# IN GREEN'S CINDERTRAP

# *Combines* ECONOMY *with* EFFICIENCY

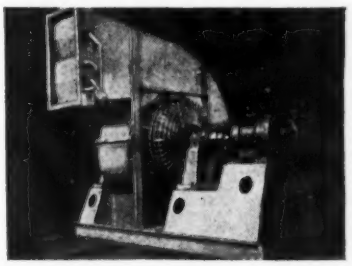
The only attention needed with GREEN'S CINDERTRAP is periodic removal of cinders from the hopper. Absence of water spray eliminates sludge and prevents corrosion. For complete details send for Bulletin 163-A.

## *ECONOMY*

- Low first cost—fits readily into existing systems.
- Negligible operating expense — no clogging, no moving parts, no water spray.
- Long life—twelve years' continuous service without replacement parts!

## *EFFICIENCY*

- Traps from 75 to 96% of the cinders in flue gas.
- Low draft loss — 0.2" maximum.
- Unaffected by variations in cinder concentration.
- Efficient for stokers.



## GREEN'S *Mechanical Draft* FANS

### GIVE TOP PERFORMANCE

High efficiency and satisfactory performance are assured with Green's Mechanical Draft Fans because they are engineered for the job. Specifications, design data and operating characteristics are given in Bulletin 166.

NOTE THESE REPEAT ORDERS!—Boston Elevated Ry. Co.—Brooklyn Edison Co.—Calco Chemical Co.—City of Fort Wayne, Ind.—City of Wyandotte, Mich.—Continental Paper Co.—Defense Plant Corp.—Eastman Kodak Co.—Fitchburg Gas & Electric Co.—General Electric Co.—Hudson Coal Co.—Interboro Rapid Transit Co.—Knott Hotels Corp.—Lorain Steel Co.—New York Navy Yard—Pennsylvania Power & Light Co.—Pennsylvania R.R. Co.—Peoples Gas & Electric Co.—Phoenix Utility Co.—Pullman-Standard Car Mfg. Co.—Scranton Electric Co.—Stone & Webster Engineering Corp.—J. G. White Engineering Co.

AIR HEATERS · ECONOMIZERS · FANS · CINDERTRAPS

THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 2, NEW YORK

# Unfailing action

# Even distribution of stresses

# Definite maximum traverse

# Fixed safety limits

*If it's Badger made it's got something*

EVERY corrugation in a Badger Self-equalizing Expansion Joint has a job to do. And it does it! It can't shift its responsibility. It must handle its share of the load equally with the other corrugations—because:

Its traverse range is predetermined, from its depth and the diameter of the joint. Then—

Its flexing is *directed*, and held to the predetermined standard by exclusive (patented) Badger DIRECTED FLEXING equalizing rings. The ALL-CURVE engaging surface of the rings conforms to the ALL-CURVE shape of the corrugation. The combination assures even distribution of stresses (1) among all the corrugations, and (2) over the entire surface of each corrugation itself. (ALL-CURVE design eliminates pockets, corners or junctions in which stresses tend to localize.)

Thus, when you've a high-temperature or high-pressure line that must be allowed a certain maximum longitudinal movement, you can determine exactly what size joint (number of corrugations) is required. No needless, costly oversize; no inadequate, disaster-threatening undersize! No guesswork—for DIRECTED FLEXING, plus Badger's special methods of forming corrugations uniformly, provide *known factors* that make the following Badger standards absolutely dependable:

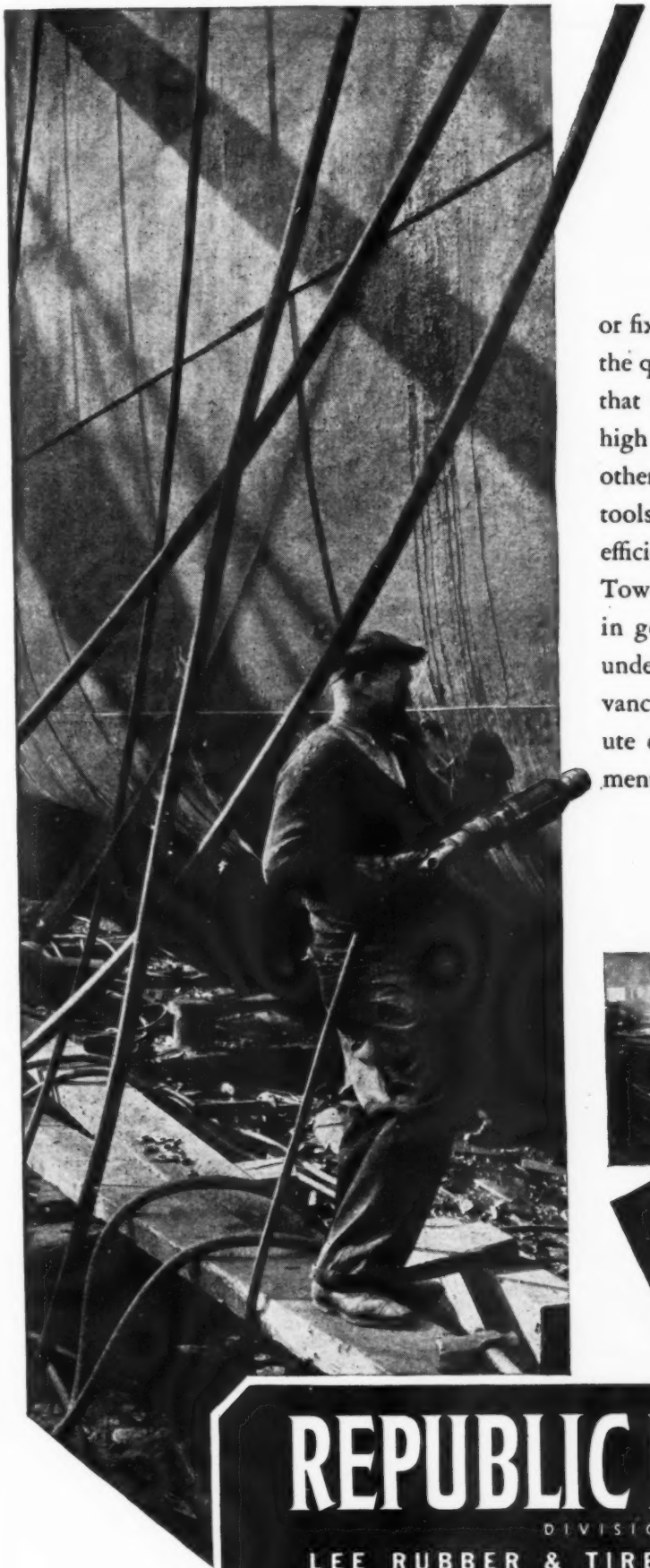
| *Diameter* | *Depth of Corrugation* | *Traverse per Corrugation* |
|---|---|---|
| 4" and 5" | 1⅛" | 5/16" |
| 6" | 1¾" | ½" |
| 8" and 10" | 2¼" | ⅝" |
| 12" and larger | 2¾" | ¾" |

***MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS*** — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a problem. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. SEND FOR BULLETIN NO. 100 (*Self-equalizing*) or NO. 200 (*Non-equalizing*).

# Badger

**E.-B. BADGER & SONS CO. • 75 Pitts Street, Boston 14, Mass.**
*AGENTS IN PRINCIPAL CITIES*

PACKLESS CORRUGATED EXPANSION JOINTS



# *New Efficiency*
## OF AIR-OPERATED EQUIPMENT WITH REPUBLIC AIR HOSE

*Air* operated plant equipment, portable or fixed, can operate only as dependably and as well as the quality of the air-carrying hose permits. This means that the hose itself must be capable of withstanding high pressures, external abuse, hot oil in the line and other punishment over extended service periods if the tools and machinery are to provide maximum work efficiency. Republic brand names, such as Champion and Tower Air Hose, long have been recognized by industry in general for structural ruggedness and long life under severest conditions. Recent technological advances have equipped Republic Air Hose to contribute even more work efficiency to air-operated equipment. Order from your nearby Republic Distributor.

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

# REPUBLIC RUBBER

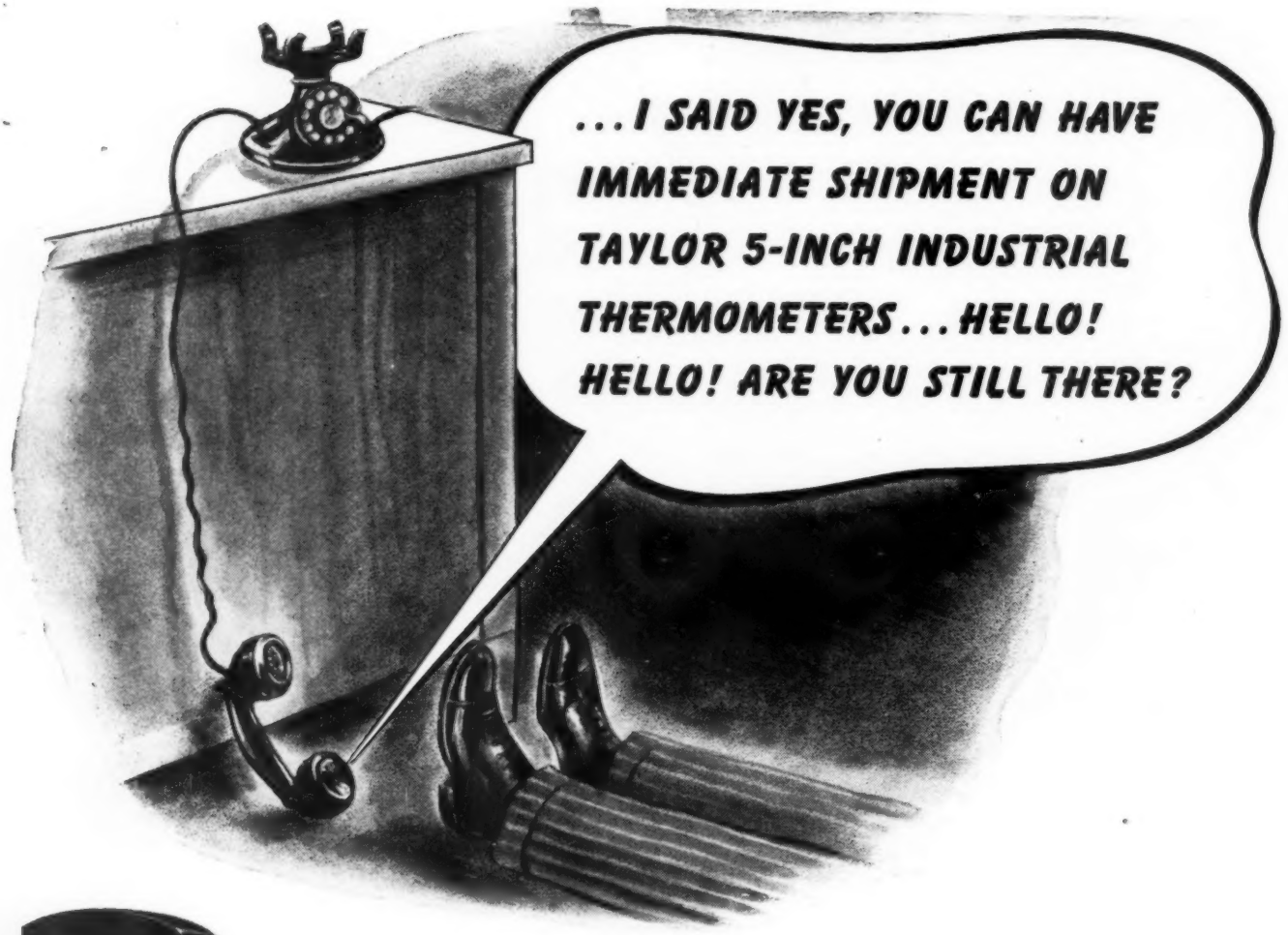
DIVISION

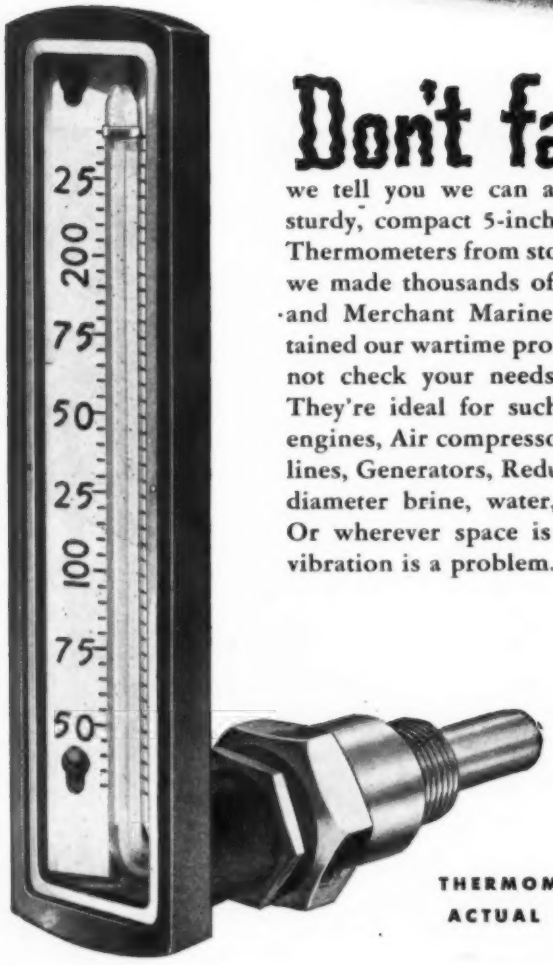
LEE RUBBER & TIRE CORPORATION

YOUNGSTOWN 1, OHIO

REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN, O.

LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.




THERMOMETER ACTUAL SIZE

# Don't faint

when we tell you we can actually ship these sturdy, compact 5-inch Taylor Industrial Thermometers from stock. The answer is, we made thousands of 'em for the Navy and Merchant Marine and we've maintained our wartime production level. Why not check your needs and order now? They're ideal for such places as Diesel engines, Air compressors, Lubricating oil lines, Generators, Reduction gears, Small diameter brine, water, and steam lines. Or wherever space is at a premium or vibration is a problem.

**Triple lens "Binoc" tubing** makes the mercury column 3 times easier to read. Bold, black figures contrast sharply with white scale. New one-piece case is rattle-proof, practically dustproof.

Variety of stem forms for installation wherever necessary. Order yours today! Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

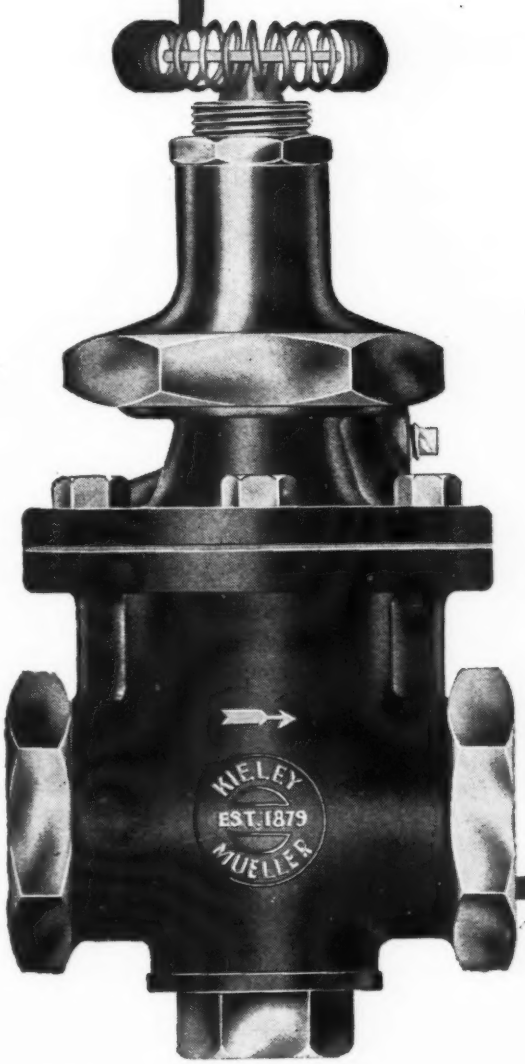
▼ ▼ ▼

*Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

**Taylor Instruments**
**MEAN**
**ACCURACY FIRST**
**IN HOME AND INDUSTRY**

# EXTREMELY ACCURATE REGULATION

## . . . Extremely Compact in Size!




**A** fraction turn of the handwheel—and you can control *exactly* the pressure of steam passing through this very compact K & M Reducing Valve. Model 481 is widely used for difficult reduction service in industrial processes—and as a primary valve in double reduction installations. Self-contained . . . made in bronze . . . available in valve sizes of ½" to 2"—with 5⅜" the maximum overall measurement, face to face! Yet it accurately controls inlet pressures up to 250 lbs. . . . maintaining constant reduced pressures of 2 lbs. to 80% of the inlet. If you have a tough pressure reduction problem, perhaps K & M #481 is the answer. Our Engineering Department invites your inquiries.

*Write for Catalog 66-C*

**KIELEY & MUELLER, INC.**
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
**2001 43rd St., North Bergen, N. J.**

*Awarded our employees for outstanding production achievement.*

**"THE STORY BEHIND THE GASKET THAT BREATHES"**

The AJAX Gasket expands and contracts — "breathes" — with changing pressure conditions—and retains the positive, secure seal you require at all times.

Note on this cutaway drawing, the small air space under each U-groove in the metal ply.

# "AJAX" *Spiralwound* BOILER GASKETS

## offer you these important features:

***Three major pressure groups*** — 0 to 499 p.s.i., 500 to 999 p.s.i., and 1000 p.s.i. up. For boiler manhole, handhole, tube cap, and other boiler assemblies.

***"AJAX" Spiralwound construction*** — permits variation of construction to meet your service requirements or specifications. Compensates for temperature and pressure fluctuations. Prevents "weep". Effects secure seal under comparatively low bonding pressure. Eliminates excessive strain on fittings. Provides higher safety factor.

***Consistent ENGINEERED high quality*** — Assures minimum boiler "outage", long service, trouble-free installations—real "installed economy" for your boiler applications.

### "Think of U. S." for every kind of gasket!

*Any material*—metal, asbestos, fiber, rubber, etc.

*Any type*—corrugated, corrugated asbestos, corrugated double jacket metal-asbestos, solid metal, serrated metal, single jacket metal-asbestos, double jacket metal-asbestos, asbestos, "french type", AJAX Spiralwound, AJAX S-R Spiralwound, oval solid metal ring type, octagonal solid metal ring type.

*Any size*—You specify it.

*Any shape*—Send "U. S." a drawing or sample gasket.

*Send a sample gasket, a drawing, a description of the application (or all three) with your inquiry. That is all we need to give you the RIGHT gasket for your particular service.*

SEE OUR CATALOG IN SWEET'S

## UNITED STATES GASKET CO.

1592 PIERCE AVENUE • CAMDEN, NEW JERSEY

# *Another* RECORD with DETROIT STOKERS

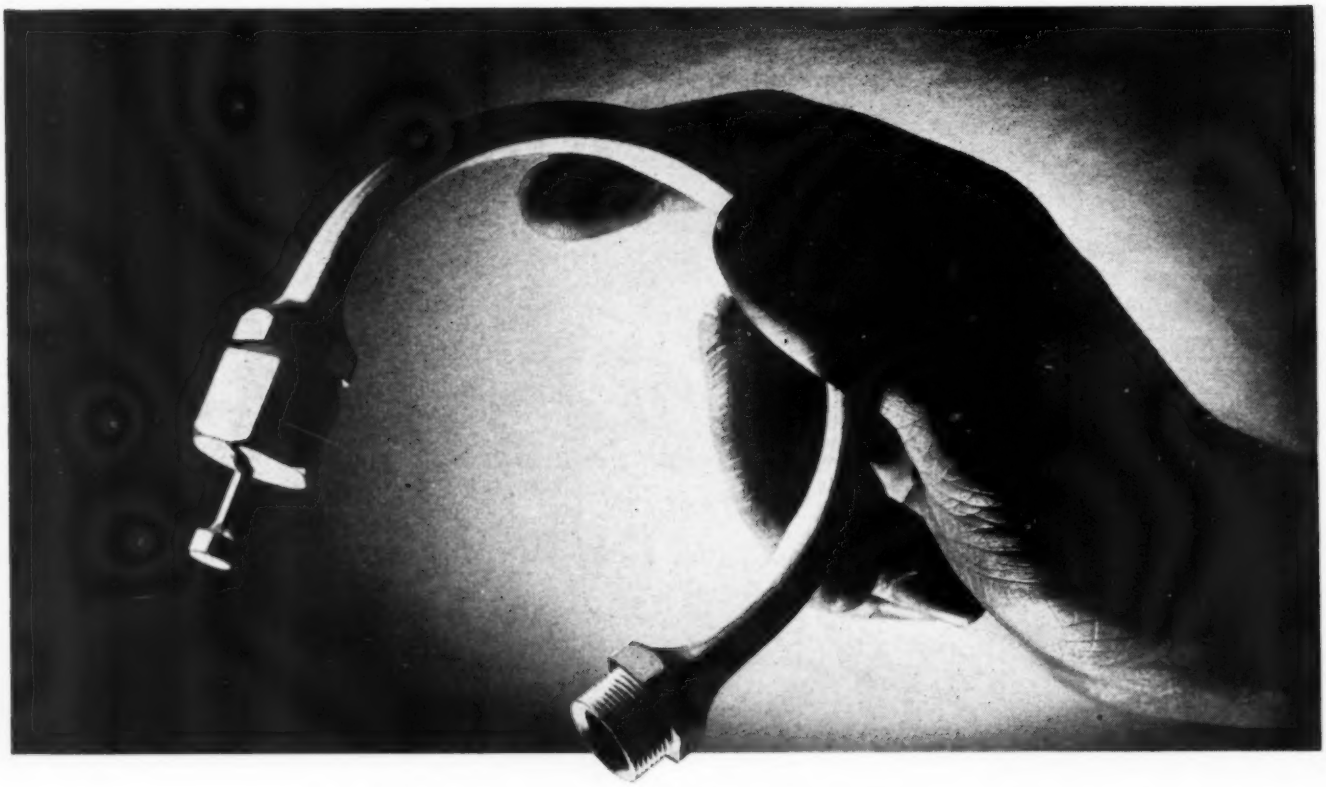
## . . . "world's record haul"

BUSINESS WEEK
NUMBER 849
AND ANOTHER SEASON ENDS
Having chalked up a world's record haul of 18,543 tons of iron ore in one trip, Pittsburgh Steamship Co.'s giant ore carrier, the Benjamin F. Fairless, and the rest . . .
BENJAMIN F. FAIRLESS
AND ANOTHER SEASON ENDS
Having chalked up a world's record haul of 18,543 tons of iron ore in one trip, Pittsburgh Steamship Co.'s
this week as their 1945 season came to an end. Grain carriers will operate until Dec. 15 when ice closes shipping on the Great Lakes until next spring. Over-all tonnage of grain shipped in the '45 season may run as high as 17,700,000 tons against 16,280,880 moved the previous season. Shipments of ore, however, were off more than 6,000,000 tons; 81,700,000 tons were hauled during the season just ended. The end of the season also found the lakes' coal movement about 5,000,000 tons short—with coal strikes blamed—of last season's total of 55,491,459 tons.

Great Lakes Ore Carrier—
Benjamin F. Fairless
Equipped with
Detroit RotoStokers

## DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan • Works at Monroe, Michigan
District Offices in Principal Cities • Built in Canada at London, Ontario



# *Portrait of Perfection—*

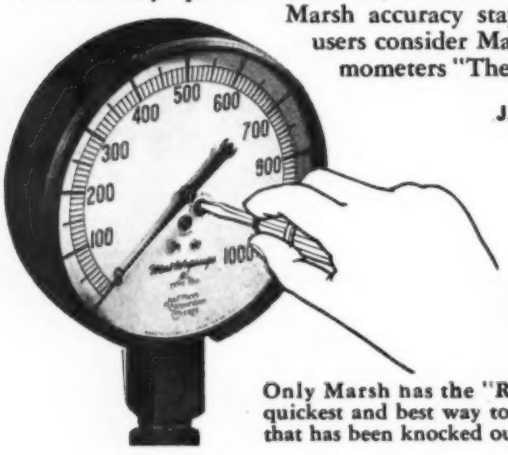
*"In the bourdon tube pressure gauge," says a physics text book, "a hollow tube with one end closed is bent into an arc. When the fluid under pressure is admitted to the open end, the tube will become less curved under increased pressure. An index moving over a scale is attached to the free end."*

● Right, professor! . . . from the standpoint of abstract science. But oh, the care required—the years of experience necessary—to make that tube right! The bourdon tube is the heart of the instrument. If it lacks required resiliency it will take a "permanent set"—fail to return to its original form when pressure ceases.

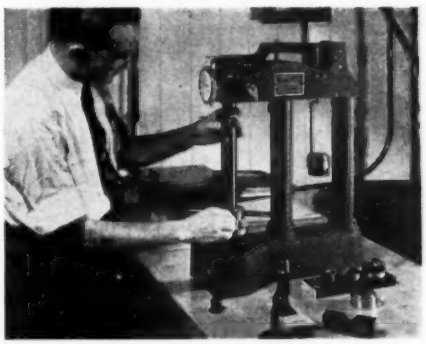
That's why we are so particular about the making of bourdon tubes for Marsh Gauges. We "mike" every length of tubing received . . . verify the hardness of every lot . . . bend and form it by exclusive Marsh processes . . . put tubes for heavier gauges through a special heat treatment. As a result, the bourdon tubes in Marsh Gauges have the proper resiliency for the particular ranges in which they are used.

In every detail of Marsh Gauges you will find similar examples of meticulously qualified material, and careful processing. That's why Marsh accuracy stays put—why thousands of users consider Marsh Gauges and Dial Thermometers "The Standard of Accuracy!"

**JAS. P. MARSH CORPORATION**
**2075 Southport Avenue**
**Chicago 14, Illinois**




Only Marsh has the "Recalibrator"—quickest and best way to correct a gauge that has been knocked out of adjustment.



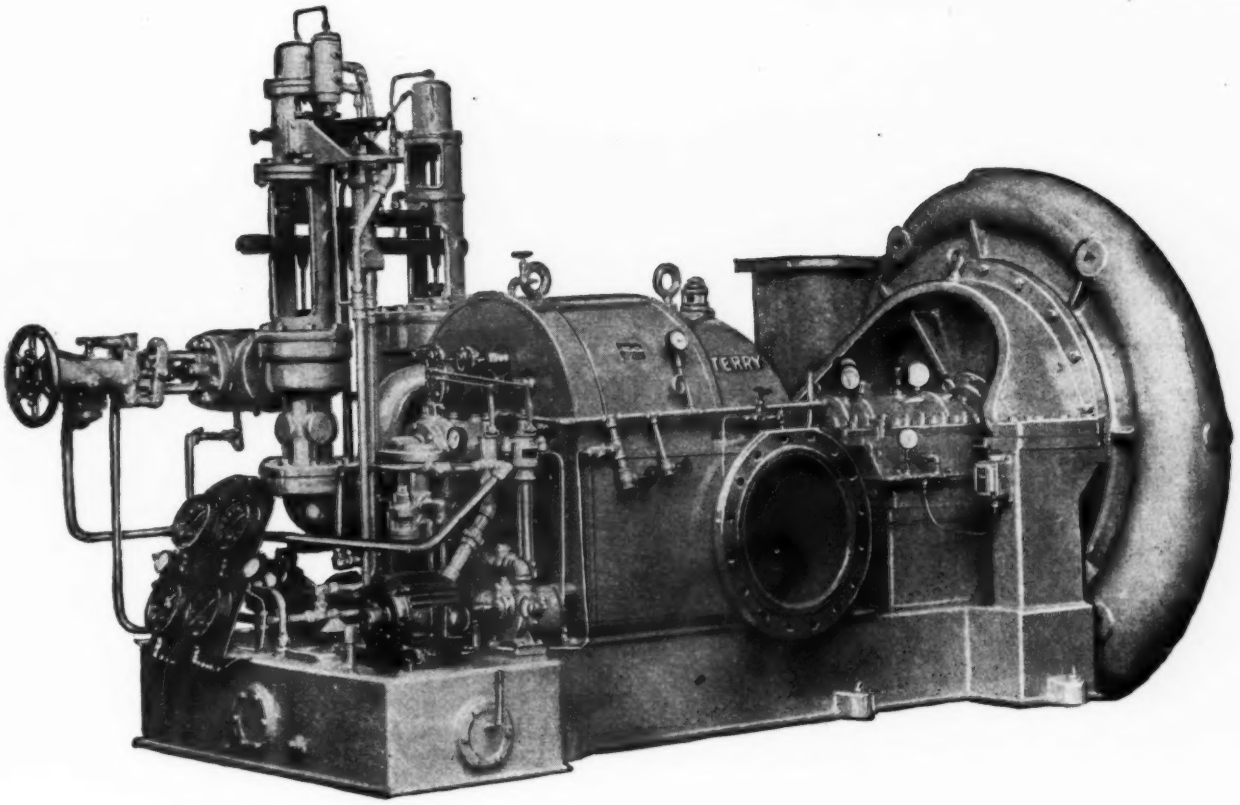
On modern laboratory equipment like this each lot of tubing is tested for hardness.

Every length of tubing used in Marsh bourdon tubes is checked with a micrometer, then tagged and classified.

# MARSH GAUGES

**"THE STANDARD OF ACCURACY"**

# *The* TERRY TURBINE




## SPECIAL MULTI-STAGED TURBINES ENGINEERED TO FIT YOUR REQUIREMENTS

Pictured above is a typical special purpose Terry Turbine. This unit is rated 332 H.P. and can be operated under any of the following conditions:

(1) As a straight high pressure condensing turbine.

(2) As a straight low pressure condensing turbine, thereby converting any excess low pressure steam into power.

(3) As a mixed pressure turbine. It will then absorb all the low pressure steam available and admit just enough high pressure steam to carry the load.

(4) As a condensing bleeder turbine. It will supply clean low pressure steam for heating or process work.

(5) Under all conditions the speed can be varied from 2800 R.P.M. to 4750 R.P.M.

If you have an application for a special purpose multi-staged turbine, Terry will be pleased to discuss the details and make recommendations. Terry Turbines are built in all sizes up to 2000 H.P.

T 1161

**THE TERRY STEAM TURBINE COMPANY**
**TERRY SQUARE, HARTFORD, CONN.**

## TRANSPORTATION PROBLEM?

Otis elevators, Otis escalators, Otis trained men and the facilities of the manufacturers of more than half of the world's elevator equipment are all available to assist you or your Architect in solving any vertical transportation problem.

**Otis Passenger Elevators** with up-to-date dispatching methods are the recognized answer to congested elevator traffic conditions.

**Otis Escalators** are used where large numbers of persons are to be carried from floor to floor in comfort and without crowding.

**Otis Freight Elevators** with a variety of control systems are designed to satisfy the most exacting requirements of floor to floor freight handling.

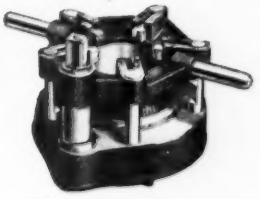
For the most efficient and economical service in vertical transportation — for a few stories or many — call your nearest Otis Representative today.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

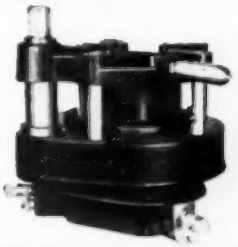
## ...SPEED UP BUILDING AND CUT COSTS!

Now's the time for pipe fitters to get set with the *right tools*—TOLEDO THREADERS—for best work in the great era of new construction ahead!

These Toledo-engineered tools will help you do a better, faster job of pipe threading—and reduce costs! Preferred by the man on the job for practical features that mean *easy-threading, accurate, dependable operation.* Backed by nearly half a century's leadership in building better pipe tools. Always specify TOLEDO! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.



**No. 2**—One of the most famous TOLEDO Pipe Tools... widely known as the most practical, durable and easiest-operating threader. Lighter than any other threader for 2½" to 4" pipe.



**No. 2 BR**—Geared adjustable threader. Capacity 2½" to 4" pipe. Equipped with a new type 3-jaw pipe holder. Easy to center. Rapid, reliable performance.

**RELY ON THE LEADER...**

**TOLEDO**

**FOR PRECISION PIPE TOOLS**

*Send for this New Folder*

HASTELLOY Facing
For Corrosion Resistance
A New Low-Cost Process To Protect Equipment From Corrosion
HASTELLOY Facing is a new process used to protect chemical plant and oil refinery equipment from corrosion by means of a facing with the HAYNES nickel-base alloy HASTELLOY.
HASTELLOY Facing is applied in two ways to those surfaces of process equipment that are exposed to corrosive agents. For relatively small areas, HASTELLOY welding rods are used to apply a corrosion-resistant deposit over the exposed areas; for large areas, such as the interior surfaces of autoclaves or reaction vessels, thin sheets of HASTELLOY are welded in place as a protective lining.
HASTELLOY Facing was developed by Haynes Stellite Company, Unit of Union Carbide and Carbon Corporation, in conjunction with a number of fabricators and operators.
The words "HAYNES" and "HASTELLOY" are registered trade-marks of Haynes Stellite Company.
HAYNES
alloys

● This new folder describes new ways to protect equipment from corrosion. It tells you about the corrosive media the HASTELLOY alloys will resist; parts that can be faced with HASTELLOY alloy; and procedures for facing with HASTELLOY sheet, plate, or welding rod.

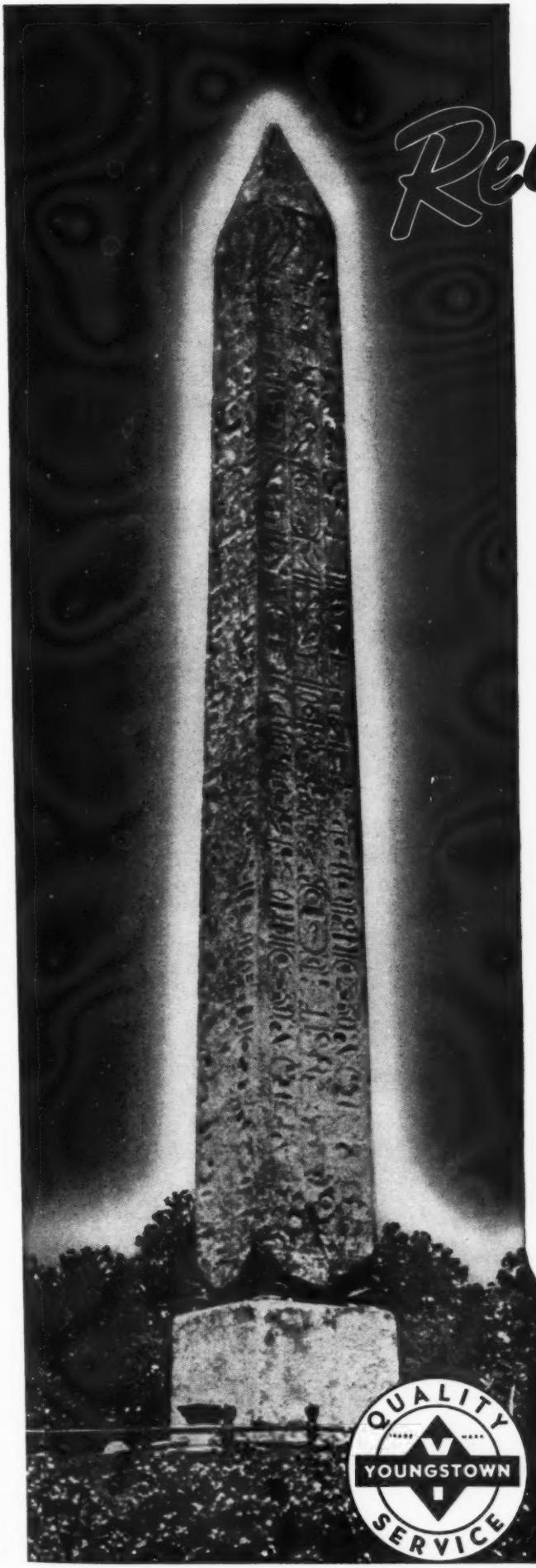
**HAYNES STELLITE COMPANY**

*Unit of Union Carbide & Carbon Corporation*

UCC

**General Offices and Works, Kokomo, Indiana**

Chicago — Cleveland — Detroit — Houston — Los Angeles — New York — San Francisco — Tulsa



# Record of a Past..

## that knew no steel

ALMOST in the shadow of the world's tallest man-made structures stands this stone obelisk--"Cleopatra's Needle," in Central Park, New York. Its hieroglyphs boast of a glory that faded 3000 years ago.

If we deciphered these inscriptions, we would look in vain for the word Steel. Ancient Egypt hewed its monuments with tools of bronze. But bronze, then as now, was not plentiful enough to go far toward improving the lot of man.

What would our civilization be if we were deprived of steel? We might have monuments of stone, but no Radio City, no towering apartments or hotels, no modern hospitals, schools, or factories. For to sustain human life and human activity, we must have vast quantities of pure water and adequate sanitary facilities...from top floor to basement...provided only through miles of steel pipe. We must have quick, safe vertical transportation, possible only with steel elevators. We must have heating systems, production machines, equipment of a hundred kinds, available in the abundance which steel alone makes possible. In short, the difference between our civilization and that of the ancient world is expressed in terms of steel.

America stands on the threshold of a New Steel Age--with steels being given new characteristics and new virtues by metallurgists and chemists. Youngstown is ready to supply alloy steels as well as carbon steels--in sheets, tinplate, pipe, conduit, bars, wire, rods and shapes--to meet your needs in fabricating the products of peace.

QUALITY V YOUNGSTOWN I SERVICE

**YOUNGSTOWN**

**THE YOUNGSTOWN SHEET AND TUBE COMPANY**

YOUNGSTOWN 1, OHIO

Export Office . . . 500 Fifth Ave., New York

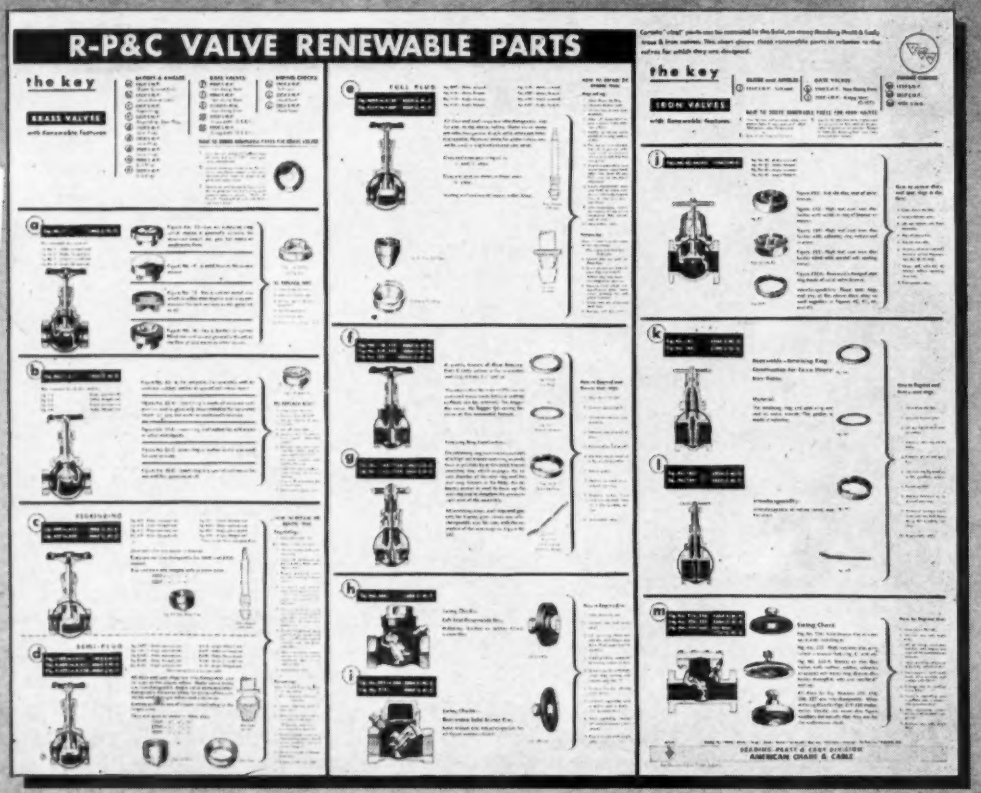
Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products-Sheets-Plates-Conduit-Bars-Electrolytic Tin Plate-Coke Tin Plate-Rods-Wire-Nails-Tie Plates and Spikes

# To Get Longer, Better Service from Valves

use this chart




Here is detailed, step-by-step instruction for renewing parts in all R-P&C globe, angle, gate and swing check valves which have renewable parts. Send for your free copy of this chart.

# READING-PRATT & CADY

With distributors in all principal cities, Reading-Pratt & Cady offers a single responsible source for practically all of your valve requirements. Moreover R-P&C can give you the benefit of long experience toward getting more economical service from your valves.

**Reading Cast Steel Valves and Fittings • Pratt & Cady Brass and Iron Valves**
**d'Este Automatic Regulating Valves**

ACCO

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**READING-PRATT & CADY DIVISION**
**AMERICAN CHAIN & CABLE**

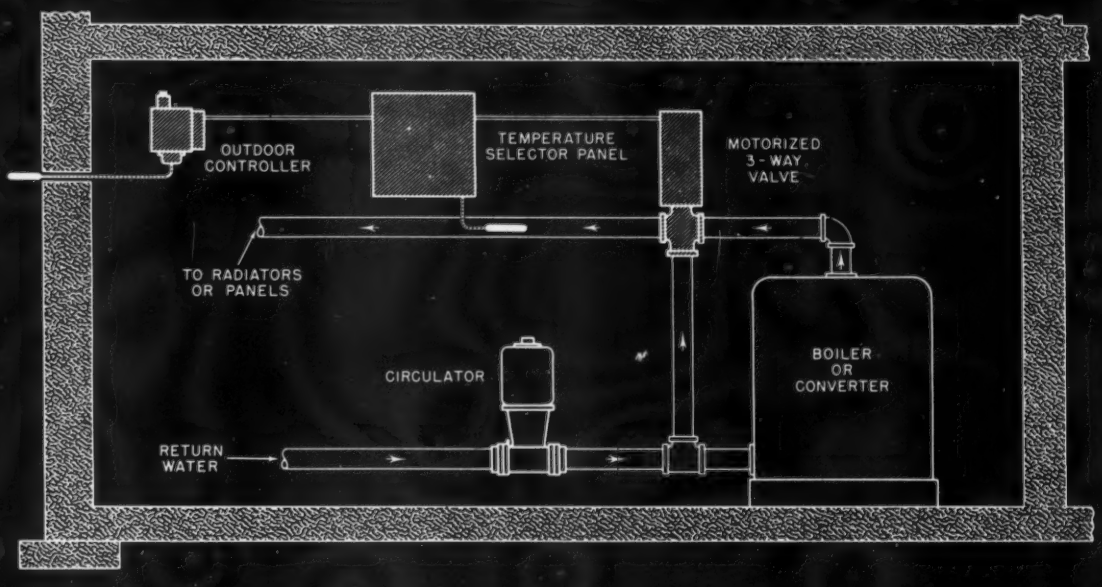
# *Now You Can . . . .*

# MATCH BOILER CAPACITY

## *of Commercial Hot Water Systems*

# TO VARYING OUTDOOR WEATHER

TEMPERATURE SELECTOR PANEL used in commercial hot water heating system hookup shown below.




WHEN outside weather changes, the capacity of the heating plant should vary with it.

This new Honeywell system, in effect does just that for commercial hot water systems. An application of Moduflow . . . this system modulates the temperature of the supply water to a higher degree as the outside temperature falls; and, conversely, to a lower degree as the weather becomes milder. This prevents wasteful and uncomfortable heating in moderate weather and insures quick response of the heating system in severe weather.

This new modern Honeywell equipment can be applied to new or existing heating plants. It is adaptable to all types of hot water heating and to all kinds of automatic burners, and is available for single or multiple zone applications.

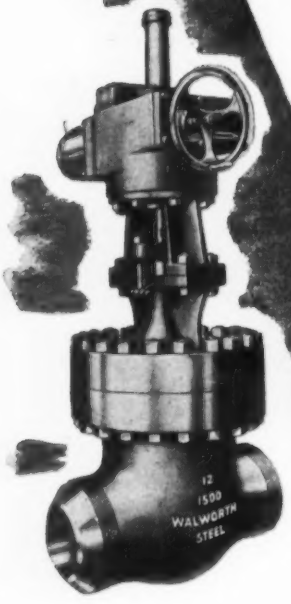
If you have not already investigated this new system, do so at once, as it not only saves fuel but produces more even and healthful heat . . . Write for complete information. Minneapolis-Honeywell Regulator Co., 2607 Fourth Avenue South, Minneapolis 8, Minn.

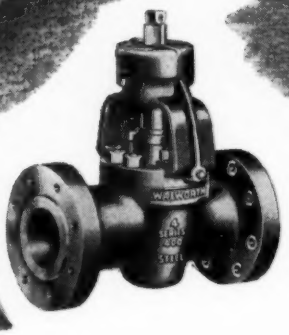
MINNEAPOLIS **Honeywell**

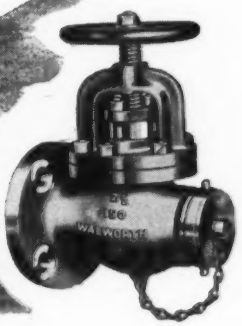
CONTROL SYSTEMS

# Walworth . . .

## MANUFACTURERS OF QUALITY VALVES AND PIPE FITTINGS FOR 104 YEARS







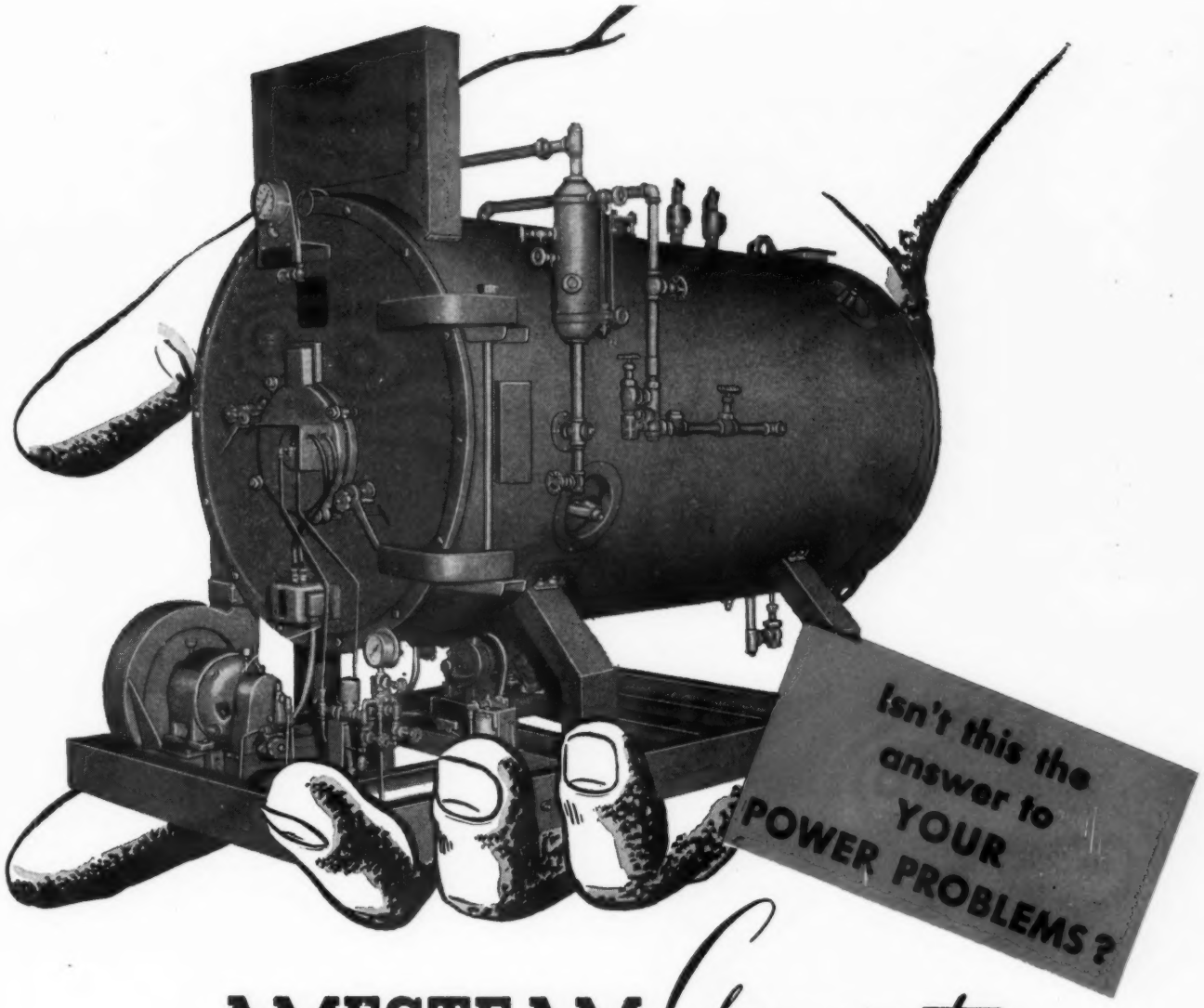
In the Walworth line there's a valve for every job, engineered to assure maximum economy of operation and trouble-free performance. Each Walworth valve has ALL the latest features of advanced design that are required for the service for which the valve is recommended.

Walworth Catalog 42 gives full information on the Walworth complete line of steel, iron body, bronze and lubricated plug valves, as well as a complete line of fittings. Your copy may be obtained upon request. Write for it today.

**Walworth** VALVES AND FITTINGS

**60 EAST 42nd STREET, NEW YORK 17, N. Y.**

**DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD**




# AMESTEAM *Generator*

With over 100 years of experience as our background, it's natural to expect Ames to know the answers to steam power questions. And in its particular field, the AMESTEAM Generator *does* provide all the answers!

For the AMESTEAM Generator is a compact, self-contained package of power ideally suited to supply speedy and reliable steam service at low cost. It takes little space, sets up quickly, supplies steam rapidly, and runs flawlessly year after year. And it is so ingeniously designed that repairs, when necessary, can be made in very little time.

For these reasons, any engineer who is looking for a steam power unit from 10 to 300 horsepower should get in touch with Ames immediately.

*A complete Return to the Boiler System, including Feed Water Pump and Condensate Tank with their accessories, is part of the standard equipment with every standard AMESTEAM Generator.*

**AMES IRON WORKS**

BOX 83 OSWEGO, NEW YORK

# *It didn't happen... BUT*

DURING the war the Metropolitan District Water Supply Commission of Boston was prepared to meet the emergency which *could* have occurred if its Chestnut Hill Pumping Station had been bombed or sabotaged.

Within an exceptionally short time . . . in a comparitively small space . . . the Commission built an emergency pumping station which had an available capacity of 45 million gallons daily in case of necessity.

To accomplish this, two Warren 18-DL-25 pumps were used, one direct-connected to a 900 HP motor and the other V-belted to a 1250 HP motor (see illustration). These pumps were originally built by Warren for de-watering service in the Quabbin Tunnel project of the Metropolitan District Commission. Thus Yankee ingenuity, plus the versatility of Warren Pumps and Warren engineering, made another worthwhile wartime contribution.

The same product and engineering skill is now available for peacetime projects. Ask for information.

If you have a pumping problem involving:

- ☐ General Water Service
- ☐ Boiler Feed
- ☐ Paper Mill Services
- ☐ Process
- ☐ De-watering
- ☐ Condensate Return
- ☐ Oil Handling
- ☐ Hydraulic Pressures

. . . or other services, your inquiry will receive prompt attention.

P2

WARREN STEAM PUMP COMPANY, INC. - - - WARREN, MASSACHUSETTS - - - *Able Representatives in Principal Cities*

**WARREN PUMPS**

# *Central Heating*—
## the first step in SMOKE ABATEMENT

**Elimination of individually fired furnaces *can do more* than any other one thing to solve the smoke problem on a city-wide basis!**

Soot fall during the heating season in highly industrialized communities runs as high as 2,000 tons per square mile per month.

●

Besides polluting the air we breathe, smoke damages health by depriving us of sunshine during winter months when we need it most!

●

Central Heating of American cities is long overdue. Steam from a central source is just as practical as water, gas, or electricity.

Central Heating, universally applied, should be a first consideration in communities which are earnestly seeking the best weapon to fight the smoke menace. Large, modern steam plants, equipped with the latest automatic devices for efficient fuel combustion and serving large districts, will practically eliminate the clouds of smoke now hanging over our cities, which come from the thousands of individual chimneys. Modern methods of steam distribution—piping steam safely at any desired high pressure, now make Central Heating practical for any application—be it an entire city, an industrial or commercial area, a large housing project or a small real estate development.

***Ric-wiL has many case histories and project studies on Central Heating in its files. If smoke abatement is YOUR problem, we can help you.***

It costs $5,000.00 to wash the soot from this one building—and the process must be repeated every few years to maintain the property. The savings to property owners in maintenance alone would go far toward paying for city-wide Central Heating.

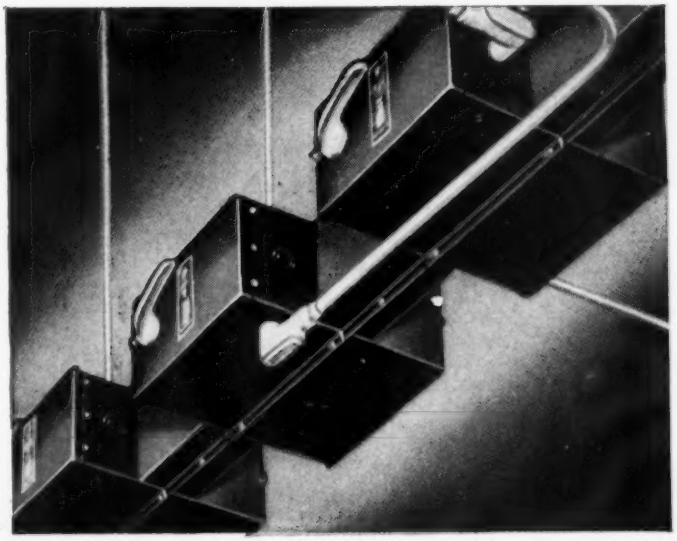
**RIC-WIL** INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

# THE BIG 3 OF ELECTRICAL DISTRIBUTION

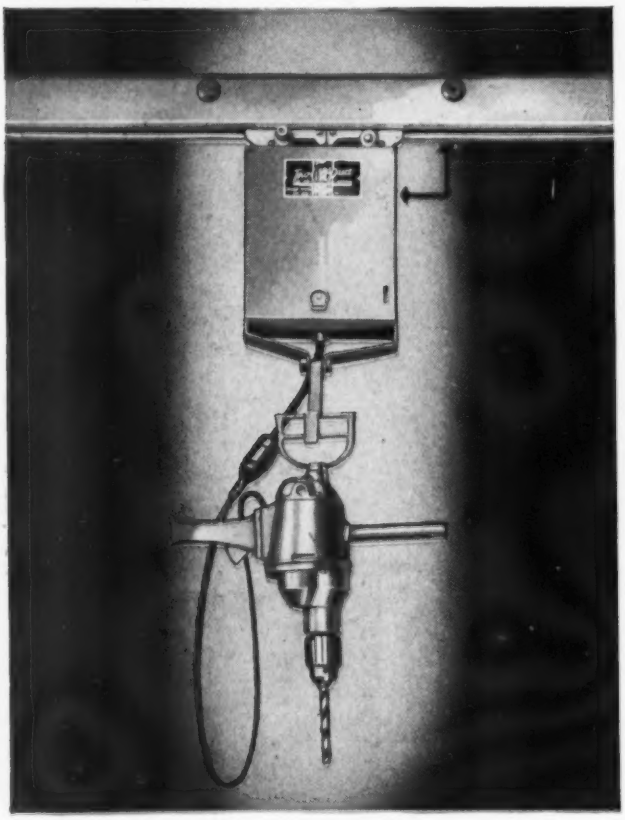
Meet the "Big 3" of electrical distribution: BullDog BUStribution DUCT, Industrial Trol-E-Duct and Universal Trol-E-Duct!

Recognized by industry as the most efficient systems of their type, these pioneers in the field of completely flexible and salvable electrical distribution systems are today saving countless hours on installation and maintenance — greatly reducing changeover time — helping to bring peacetime production to top speed and efficiency.

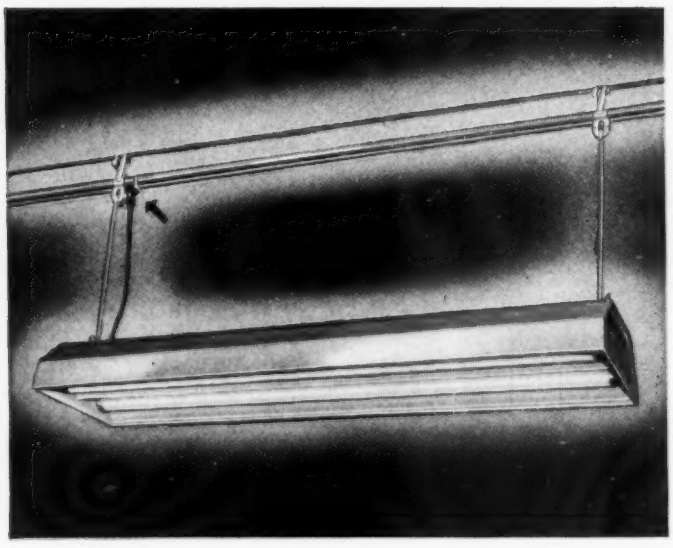
If you hope to successfully compete in the peacetime battle of costs ahead, it will pay you to investigate these superior BullDog Electrical Distribution Systems. Write now for complete details.



**1 FOR PLUG-IN POWER,** BullDog BUStribution DUCT which includes a variety of circuit protective tap-off Bus Plugs enables you to spot and plug-in plant machinery almost as readily as you plug-in your vacuum cleaner at home. No lost motion—no lost time! RATINGS: Plug-in Type up to 1350 Amps. Feeder Type up to 4000 Amps. 575 Volts or less.



**2 FOR PORTABLE TOOLS,** Cranes, Hoists or similar moving "loads" BullDog Industrial Trol-E-Duct supplies a source of safe, mobile power by means of Trolleys which, as they move through the elongated slot in duct, transmit current from the duct bus bars to the moving load. RATING: 90 Amps. 575 Volts or less.



**3 FOR COMPLETELY FLEXIBLE LIGHTING,** Universal Trol-E-Duct is a busway wiring system that can be tapped with Plugs or Trolleys at any point through the continuous slot in duct casing . . . Always keeps your lighting modern, for changes in type of fixture can be as readily made as changes in lighting positions. RATING: 50 Amps. 250 Volts or less.

## BULLDOG

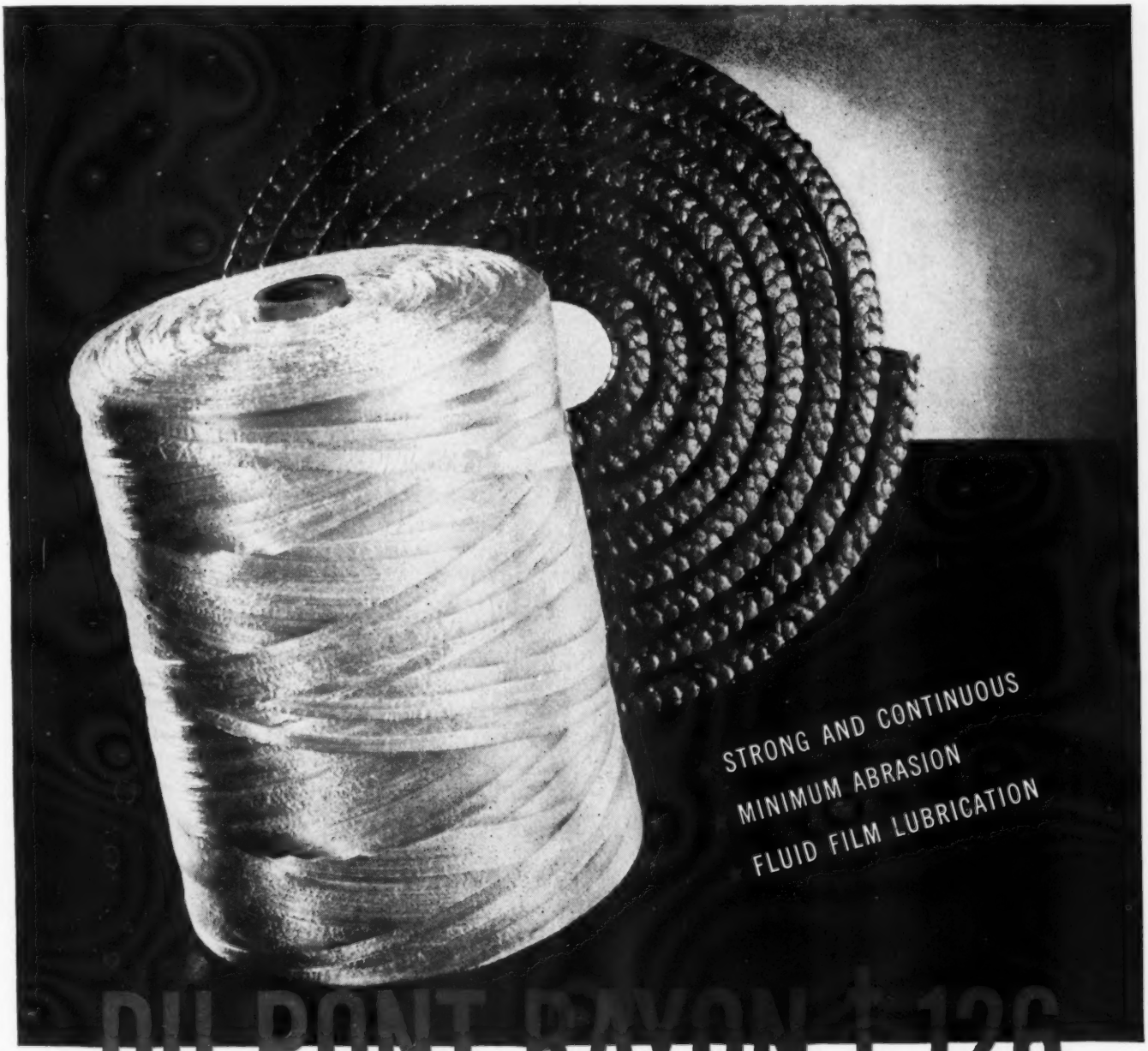
ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN.
In Canada:
BullDog Electric Products of
Canada, Ltd., Toronto.
Field Offices in All Principal Cities

*Manufacturers of*
Vacu-Break Safety Switches — SafToFuse Panelboards — Switchboards — Circuit Master Breakers — BUStribution Duct, for "plug-in" power — Industrial Trol-E-Duct for moving "loads."

# Du Pont Improves Hydraulic Packing

**(ALL LEADING PACKING MANUFACTURERS CAN SUPPLY IT)**




# DU PONT RAYON T 126

## the precision packing fiber

Consider what would be added to packing performance if the basic fiber were continuous and man-controlled in uniformity. No exposed ends. No bulges. No weak spots. The results are long life for the packing ... minimum friction on moving metal parts... lower maintenance.

**The Great Strength** of packing from Du Pont Rayon T 126 derives from the chemical formula used and from special handling methods developed by Du Pont.

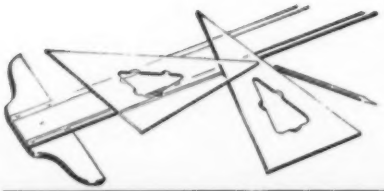
**A variety** of Rayon T 126 packings are now offered for use on hydraulic equipment. Types are available for service against brine and hot or cold water . . . at high or low pressures.

**Ask your supplier** for a trial run of packing fabricated from Rayon T 126 and use as he recommends.

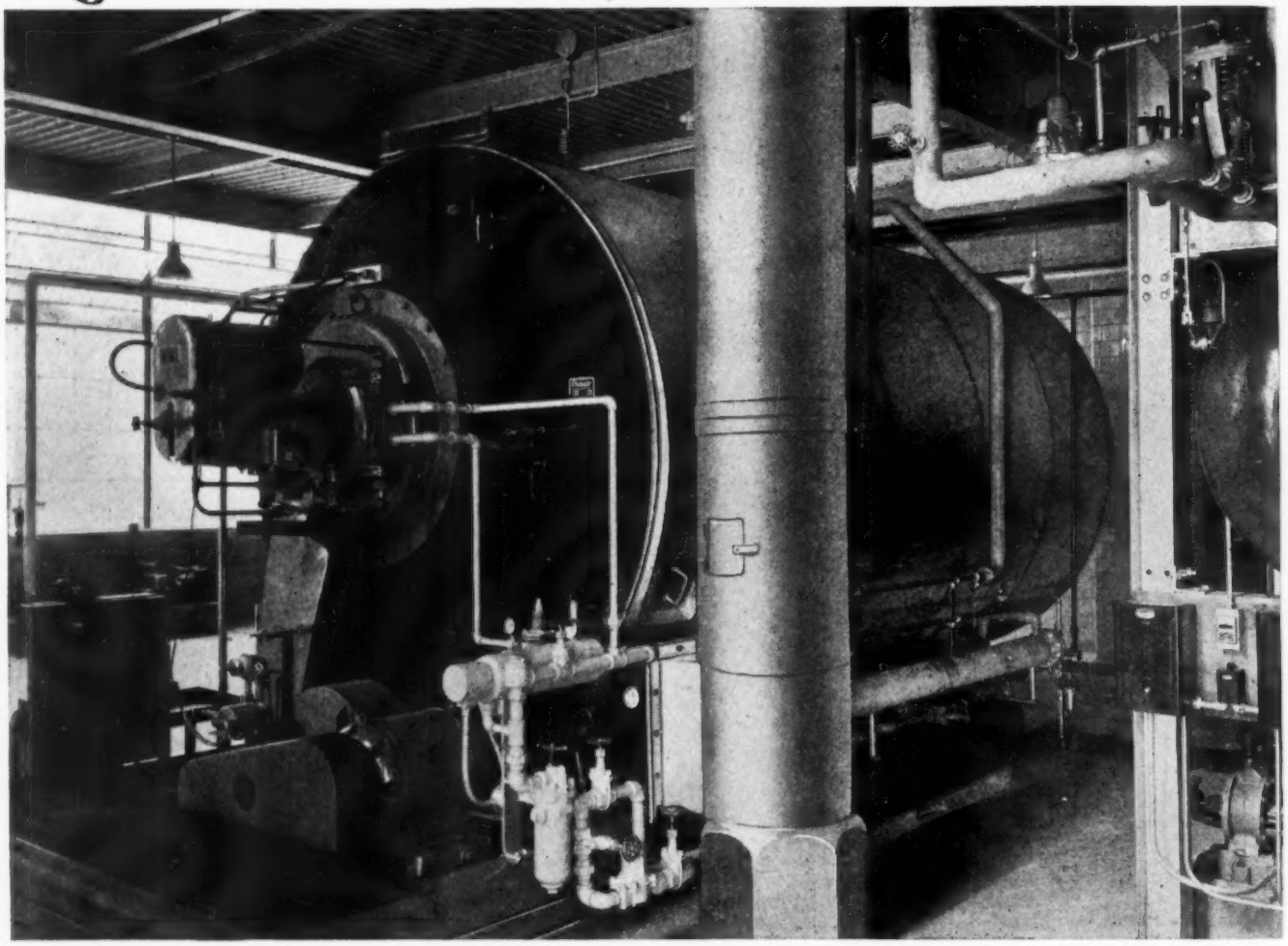
DU PONT
REG. U. S. PAT. OFF.

**BETTER THINGS FOR BETTER LIVING**
***. . . THROUGH CHEMISTRY***

**Rayon Department, E. I. du Pont de Nemours & Co. (Inc.) . . . Wilmington 98, Delaware**



# PLAN NOW TO CUT YOUR STEAM COSTS...



*Gain a Clean, Efficient Boiler Room . . . Lower Steam Costs . . . with a Cleaver Brooks Steam Generator . . . planned for Your Needs*

## Lower Steam Generating Costs Lead To Lower Production Costs . . .

CLEAVER-BROOKS Steam Generators are "tailored" for their job. They are installed to meet an individual plant's needs; Cleaver-Brooks puts unit into initial operation, instructs as to operation, care, and maintenance.

No recommendations are made until sufficient facts and figures have been compiled and a careful analysis completed of your steam requirements on the basis of today's load and tomorrow's anticipated need.

With this information, the most economically sized steam generator and related equipment to handle the load is then determined.

Application engineering, plus basically sound design and construction means that the maximum of value is provided from the day your Cleaver-Brooks Steam Generator is installed.

**CLEAVER-BROOKS COMPANY, 332 E. Keefe Avenue, Milwaukee 12, Wisconsin**

### Self-Contained and "packaged"—

Delivery consists of a "packaged" unit. Connections to service outlets are all that is needed. No smokestack is used — a simple vent carries away all products of combustion. No extra foundation is required. Compact—the unit fits into limited space and low headroom locations. Sizes: 22 models — 15 to 500 hp; pressures 15 to 200 lbs. p.s.i.

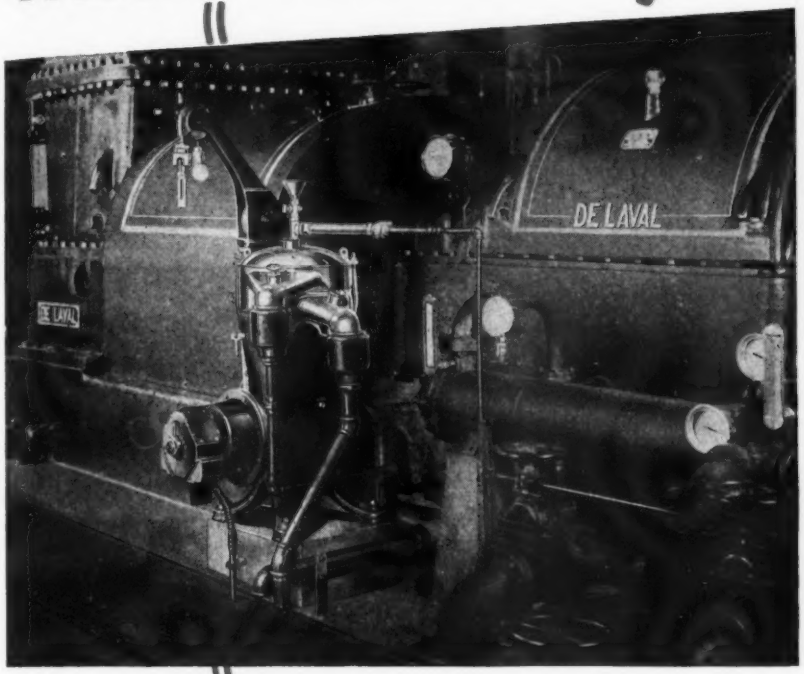
### Money-making performance—

The Cleaver-Brooks Steam Generator is designed for easy operation and low upkeep cost. Operation is at 80% efficiency from full load down to 30% of its rating. The high heat transfer from the 4-pass, down-draft boiler produces fast steaming. A boiler room as clean as the home or office is possible through use of oil for fuel.

**WRITE** on your business letterhead for the Free Steam Cost-Calculator —a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

**Cleaver-Brooks**
STEAM GENERATORS

# WHEN IS A TURBINE *Fully* PROTECTED?




## ...WHEN THE TURBINE OIL IS FREE FROM *DIRT* AND *WATER*

TURBINES require protection from two different causes of lubrication failure—***dirt*** and ***water***. Removal of dirt alone merely does half a job. That is why De Laval Oil Purifiers are so much more effective for maintaining turbine oil than any other means available. They instantaneously remove solid foreign matter and any moisture that may be present as well.

It is extremely important to get this ***double*** protection, for water is the real trouble-maker as often as not. For example, condensate in oil leads directly to the formation of sludge, and of course there is always the possibility of a major water leak which might lead to serious emulsification and very real trouble.

De Laval centrifugals have another advantage—they do not remove oil-soluble additives. Action within the Purifier is wholly mechanical and the oil is discharged with such additives intact.

In short, De Laval Oil Purifiers maintain oil in condition most nearly identical with that of new oil.

• Write for Bulletin No. 400.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

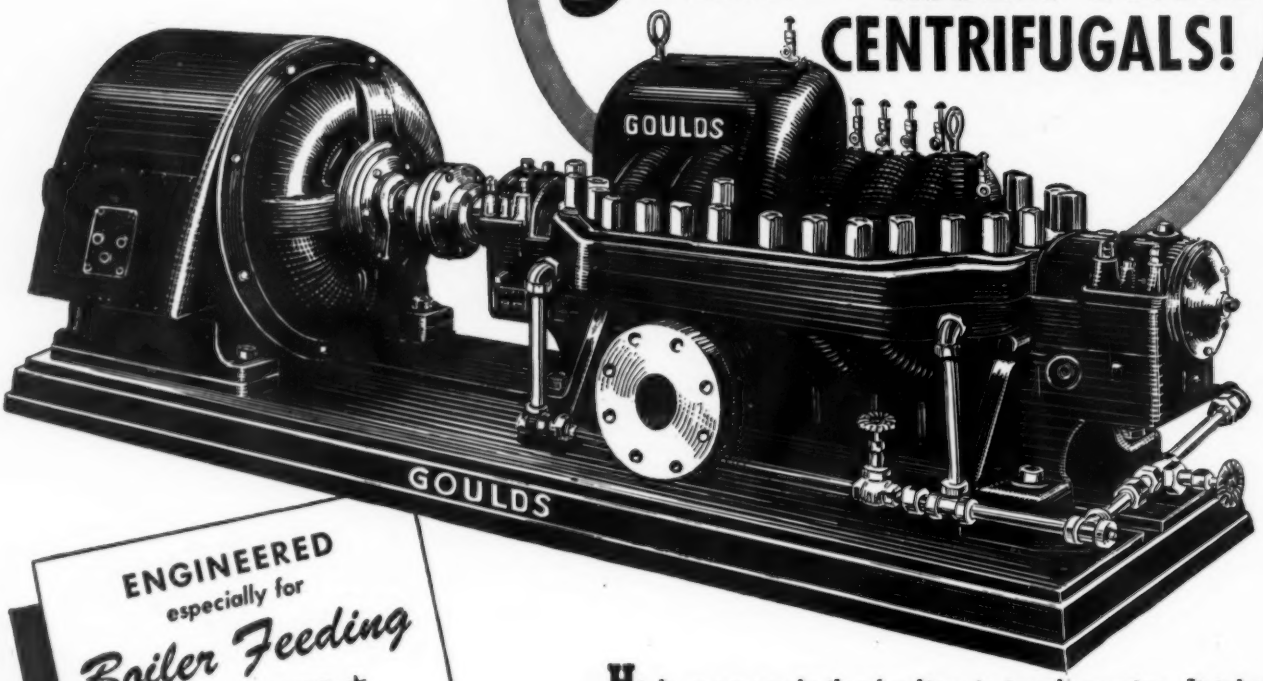
# DE LAVAL OIL PURIFIERS

**FOR MORE DEPENDABLE POWER PRODUCTION**

# They've got Stamina

## FOR TOUGH 24-HOUR SERVICE

## Goulds MULTI-STAGE CENTRIFUGALS!




**ENGINEERED**
especially for
***Boiler Feeding***

★ **FEATURING** ★

- **Hydraulically balanced impellers**
- **Pressure relieved stuffing boxes**
- **Maintained efficiency—minimum internal leakage**
- **Assured bearing alignment**
- **Accessibility for maintenance**

High pressure boiler feeding is tough service. It takes real engineering to build pumps for this work . . . pumps that give a good account of themselves, year after year. How well Goulds engineers do their job is reflected in the thousands of Goulds Multi-Stage pump installations throughout the world.

If you require pumps of this type, Goulds offers them in sizes from 3" to 8" and in capacities from 50 to 2250 G.P.M. with a maximum head of 3200 ft. Such a degree of selectivity enables you to choose the right pump for the job with maximum initial and operating economy. For further details, write pump headquarters or your nearest Goulds office.

# Goulds PUMPS, INC.

**the PUMP FOR the JOB**

**SENECA FALLS, N. Y.**

# Over 57 Million Feet
## OF SERVICE SATISFACTION

Complete warehouse stocks of B&W Pressure Tubes in all standard sizes and lengths are maintained by local distributors in principal cities to give you prompt, reliable service on routine or emergency requirements.

## . . . with B&W WELDED PRESSURE TUBES

THEY'RE only 33 months old—yet today B&W *Electric-Resistance Welded* Pressure Tubes are thoroughly tried and proved products as is indicated by the impressive quantity that has been installed in the short period they have been available.

More than 57,000,000 lineal feet have already gone into steam generating and heat transfer equipment of all kinds in services that put a high premium on tube dependability, safety, ease of installation and economy.

No one could have a stronger incentive than B&W to produce the best possible pressure tubes because no other tube manufacturer is an integral part of an organization that also builds steam generating and heat transfer equipment. At stake in every foot of B&W Welded Pressure Tubing therefore is a 75-year reputation for highly dependable performance earned by millions of dollars worth of B&W equipment of which B&W tubes are an important part.

These are good points to keep in mind next time you buy pressure tubes for any heat transfer equipment.

Other B&W Products

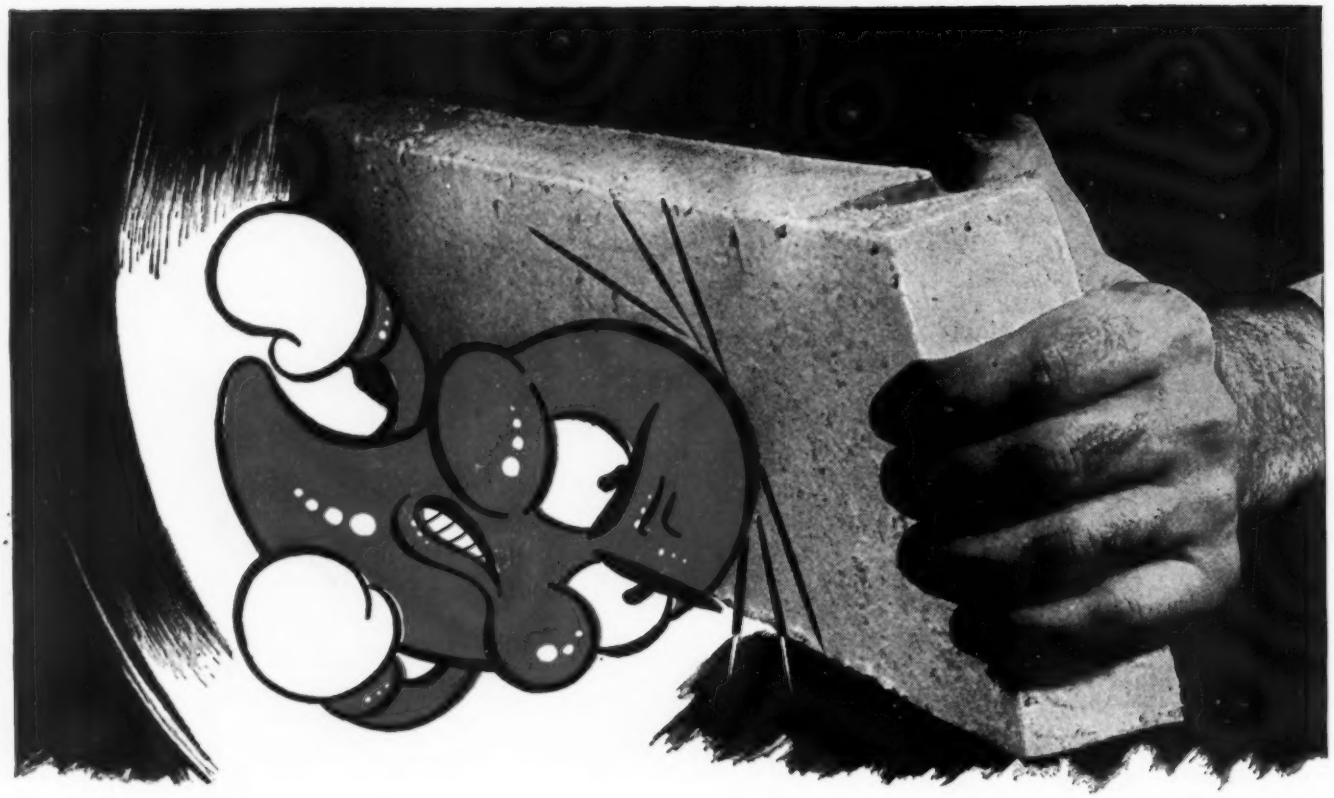
**THE BABCOCK & WILCOX CO.**
**85 LIBERTY STREET • NEW YORK 6, N. Y.**

Water-Tube Boilers, for Stationary Power Plants, for Marine Service • Water-Cooled Furnaces • Superheaters • Economizers • Air Heaters • Pulverized-Coal Equipment • Chain-Grate Stokers • Oil, Gas and Multi-fuel Burners • Refractories • Process Equipment.

**BABCOCK & WILCOX SEAMLESS & WELDED TUBES**

THE BABCOCK & WILCOX TUBE COMPANY
WELDED TUBE DIVISION, ALLIANCE, OHIO • SEAMLESS TUBE DIVISION, BEAVER FALLS, PA.

TA-1357



# *Block* those BTU's!

**NATIONWIDE DISTRIBUTION**— Warehouse stocks of the broad Carey line provide service regardless of job location.

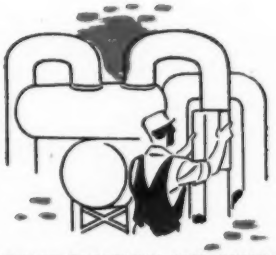
**CAREY INSULATION ENGINEERING SERVICE** makes available the knowledge and experience of leading authorities.

Tempt a BTU with improper or inadequate insulation and what happens? Energy vanishes into thin air . . . abnormal overloads and faulty operation may result . . . certainly a lot of precious fuel is wasted.

The remedy is *proper* insulation . . . *adequate* insulation.

For efficient high temperature operation, Carey makes a complete line of industrial insulations — blocks, sheets, cylindrical shapes and insulating cements. In addition, Carey engineers are ready to help you determine the *one best* insulation or combination for any specific requirement.

To utilize Carey's 50-odd years of heat insulation engineering experience just write—



**TRAINED ERECTION AND SERVICE CREWS** "make sure" the job is done right.

**BROAD LINE FROM ONE SOURCE.** No need to compromise with desired results. You get the right insulation for the job.

THE PHILIP CAREY MANUFACTURING CO.
LOCKLAND, CINCINNATI 15, OHIO

Carey

IN CANADA: THE PHILIP CAREY CO., LTD.
OFFICE AND FACTORY: LENNOXVILLE, P. Q.

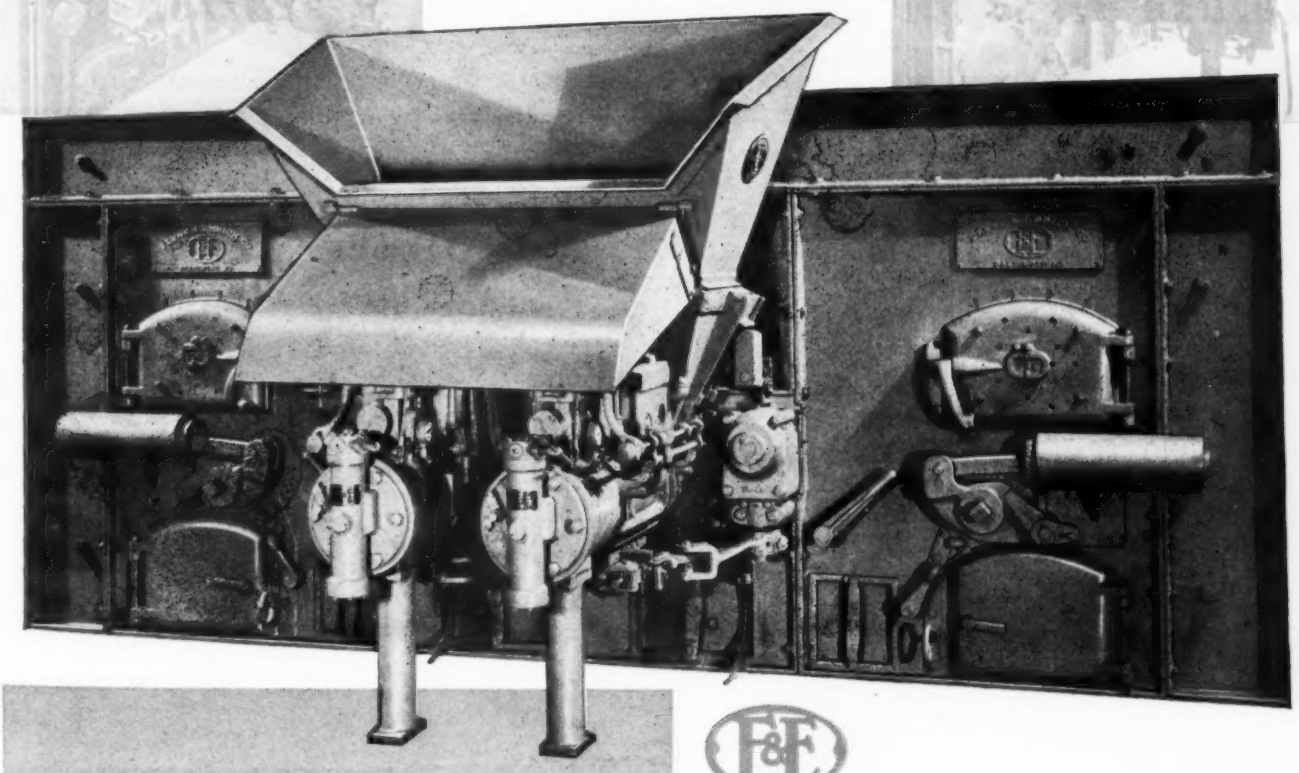
Careyduct • Industrial Insulations • Rock Wool Insulation • Asbestos Shingles and Siding • Asphalt Shingles and Roofings
Built-up Roofing • Roof Coatings and Cements • Waterproofing Materials • Asphalt Tile Flooring • Pipeline Felt
Expansion Joint • Asbestos Wallboard and Sheathing • Corrugated Asbestos Roofing and Siding • Miami-Carey Bathroom Cabinets and Accessories

# SERVING OVER 700,000 BOILER HORSEPOWER

# "F & E" UNDERFEED STOKERS

There is an "F & E" Underfeed Stoker to meet your requirements—whether they be 1000 lbs. of steam per hour or 40,000!

See the "F & E" representative in your locality, your own consulting engineer or write manufacturer for information that tells WHY and HOW "F & E" Underfeed Stokers increase output of boilers, reduce fuel bills, provide dependable operation, increase efficiency.



**THE ONLY STOKER WITH THIS COMBINATION OF ENGINEERED FEATURES**

**1-Choice of Electro-Hydraulic or Steam Ram Drive; 2-Internal Timer Governor; 3-Sliding Bottom Retort; 4-Renewable Ram Case Liner; 5-Exterior Fuel Bed Adjuster; 6-High Efficiency Tuyeres**

**FLYNN & EMRICH CO.**

*Established 1842*

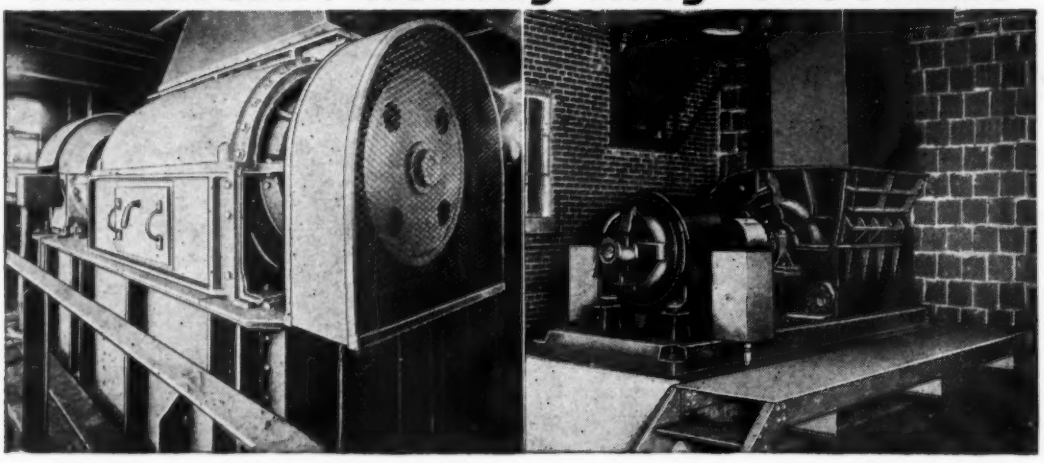
HOLLIDAY & SARATOGA STREETS, BALTIMORE 2, MARYLAND

*Representatives in Principal Cities*

# FOR A COAL CRUSHING OPERATION THAT'S COMPACT and COMPLETE

*...install*

## AMERICAN *Rolling Ring* CRUSHERS



## *Americans give high tonnage, uniform sizing and refuse disposal without auxiliary operations....*

The manganese steel shredder rings are an exclusive patented feature of American. Each ring, with its 20 cutting teeth, revolves at the proper centrifugal force *splitting coal instead of crushing it.* The shredder rings, revolving free on their own shafts, deflect from tramp iron.

These two power plant installations of American Crushers are typical of many throughout the world. Their compactness of design and construction makes for a complete, efficient installation in limited headroom and with savings of valuable space.

No auxiliary operations or equipment is necessary to the high performance of Americans. No extra operational or maintenance labor is required for the operation of Americans.

An American Rolling Ring Crusher handles its own refuse. There is no refuse disposal problem in an American installation. American Rolling Ring Crushers provide a *complete* high capacity, *extremely* low cost crushing operation uniformly reducing ROM coal to stoker or pulverizer sizes—handling waste and rejecting tramp iron—for complete safety to mechanical firing devices.

There's an American to fit your operation. Capacities from 25 to 500 TPH.

***WRITE FOR "CRUSHING COAL AT LESS THAN 1¢ PER TON"***

**American PULVERIZER COMPANY**

*Originators and Manufacturers of Ring Crushers and Pulverizers*

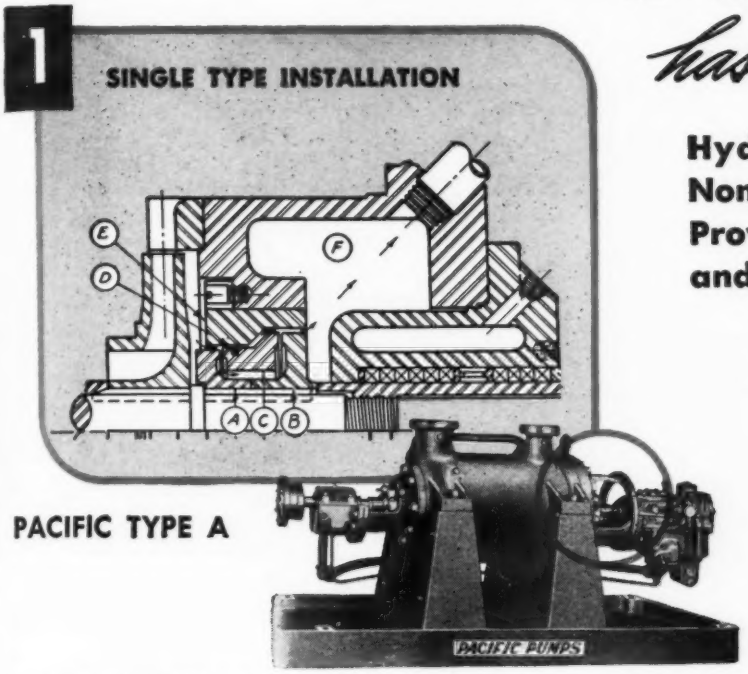
**1429 MACKLIND AVE.**
**ST. LOUIS 10, MO.**

# Only Pacific

*has this floating seal*

**Hydraulically Balanced—Self-Adjusting—Non-Seizing—Pressure Break-Down Device—Proved in operation under the most severe and exacting conditions of service.**

**1 SINGLE TYPE INSTALLATION**




**PACIFIC TYPE A**

**A. LOW PRESSURE SEAL PLATE** Rotates with shaft

**B. HIGH PRESSURE SEAL PLATE** Rotates with shaft

**C. SEAL BUSHING**—Floats Between Low and high pressure seal plates with liquid film between adjoining faces

**D. PISTON RING**

**E. SEAL HOUSING**

**F. CHAMBER WITH BY-PASS LINE**—For returning liquid to suction of pump or other vessel.

*Applications:*

**SINGLE TYPE FLOATING SEAL**

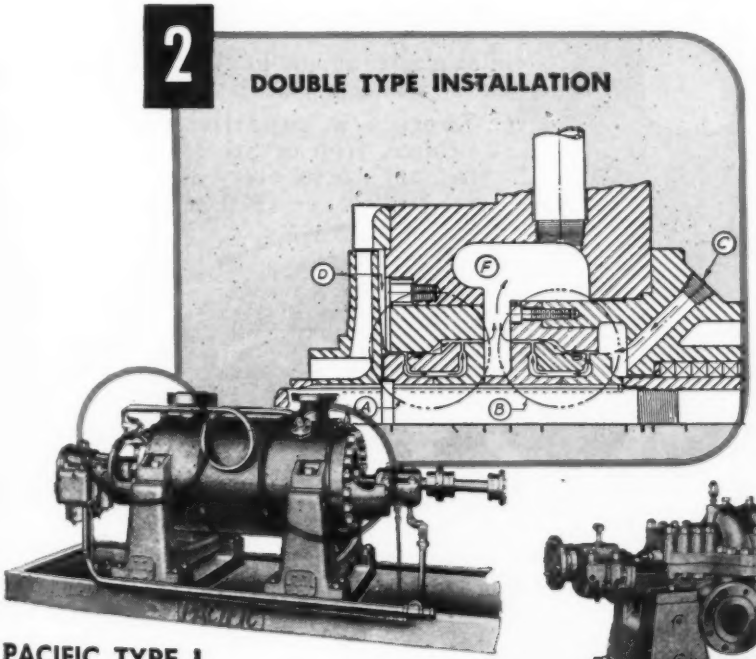
1. To balance the lateral thrust of the rotating element.
2. To break down high pressure on either or both the suction and discharge to obtain low pressure on the stuffing box packing.
3. To prevent pump overheating and becoming vapor bound when operating under variable speed-capacity conditions including shut off.

**DOUBLE TYPE FLOATING SEAL**

1. To prevent liquid being pumped from coming in contact with the packing.
2. Permits sealing packing with clean, cool liquid.

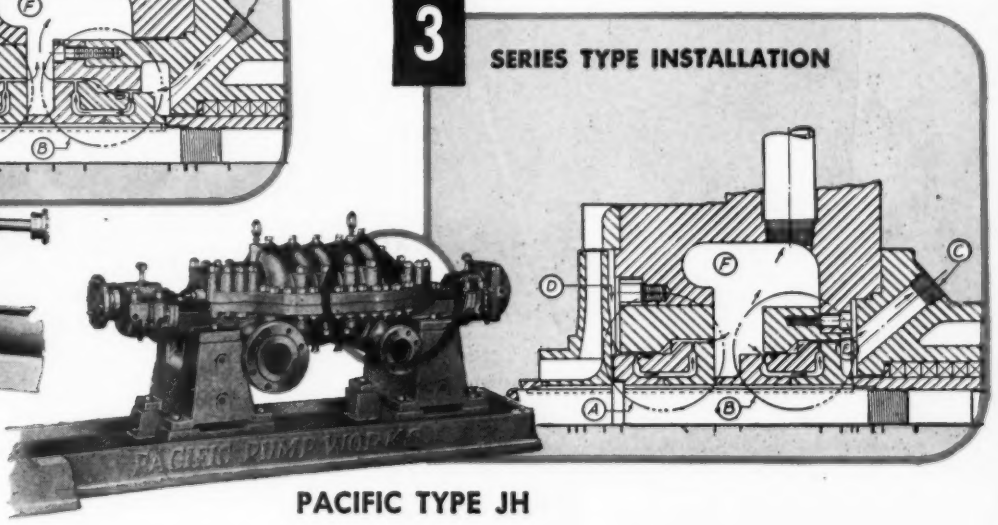
**PACIFIC PUMPS INC., Huntington Park, Calif.**
*One of the Dresser Industries*
Export Office: Channin Bldg., 122 E. 42nd St., N. Y.

**2 DOUBLE TYPE INSTALLATION**




**PACIFIC TYPE I**

**3 SERIES TYPE INSTALLATION**




**PACIFIC TYPE JH**

# PACIFIC *Engineered* PUMPS

# *The* Inside Story *of a Great* VALVE

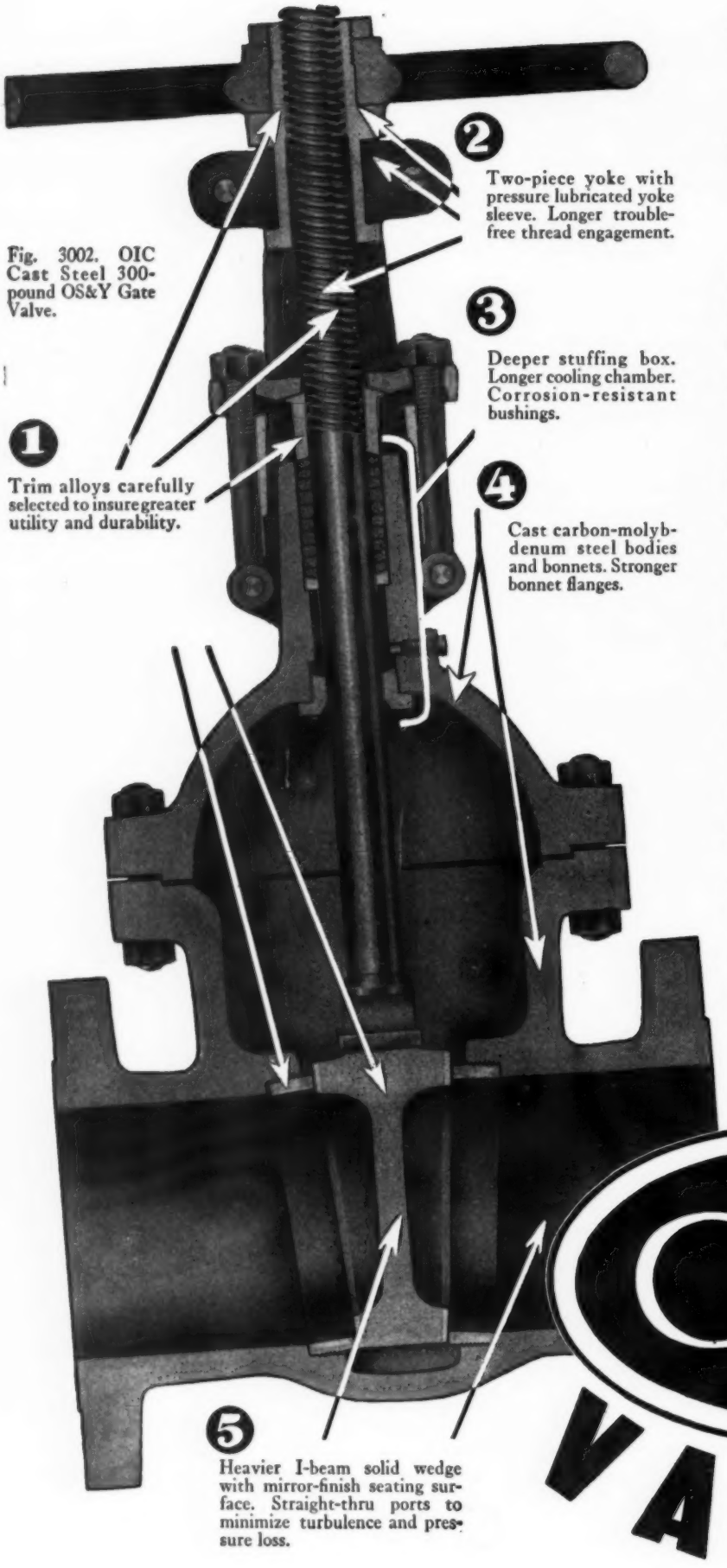

2
Two-piece yoke with pressure lubricated yoke sleeve. Longer trouble-free thread engagement.
3
Deeper stuffing box. Longer cooling chamber. Corrosion-resistant bushings.
1
Trim alloys carefully selected to insure greater utility and durability.
4
Cast carbon-molybdenum steel bodies and bonnets. Stronger bonnet flanges.
5
Heavier I-beam solid wedge with mirror-finish seating surface. Straight-thru ports to minimize turbulence and pressure loss.

Fig. 3002. OIC Cast Steel 300-pound OS&Y Gate Valve.

GET the full inside story of this great OIC Cast Steel Gate Valve and you'll understand why so many Central Power Generating Plants, Industrial Power Units and General Industrial Processing Operations are changing over to OIC's.

They're replacing with and standardizing on OIC's to get: full free flow . . . positive control . . . longer uninterrupted service . . . quicker, easier repacking under pressure . . . lower maintenance costs.

The OIC repacking feature alone makes OIC's unique among all valves. The special OIC gland linking device lifts the two-piece gland assembly as one unit and conveniently locks it up out of the way during repacking.

The gland eye bolts banish all woe of lost or misplaced bolts by swinging out of the way for repacking.

These are just two of the many reasons why OIC's are the proven valves of greater value, greater service and lower costs.

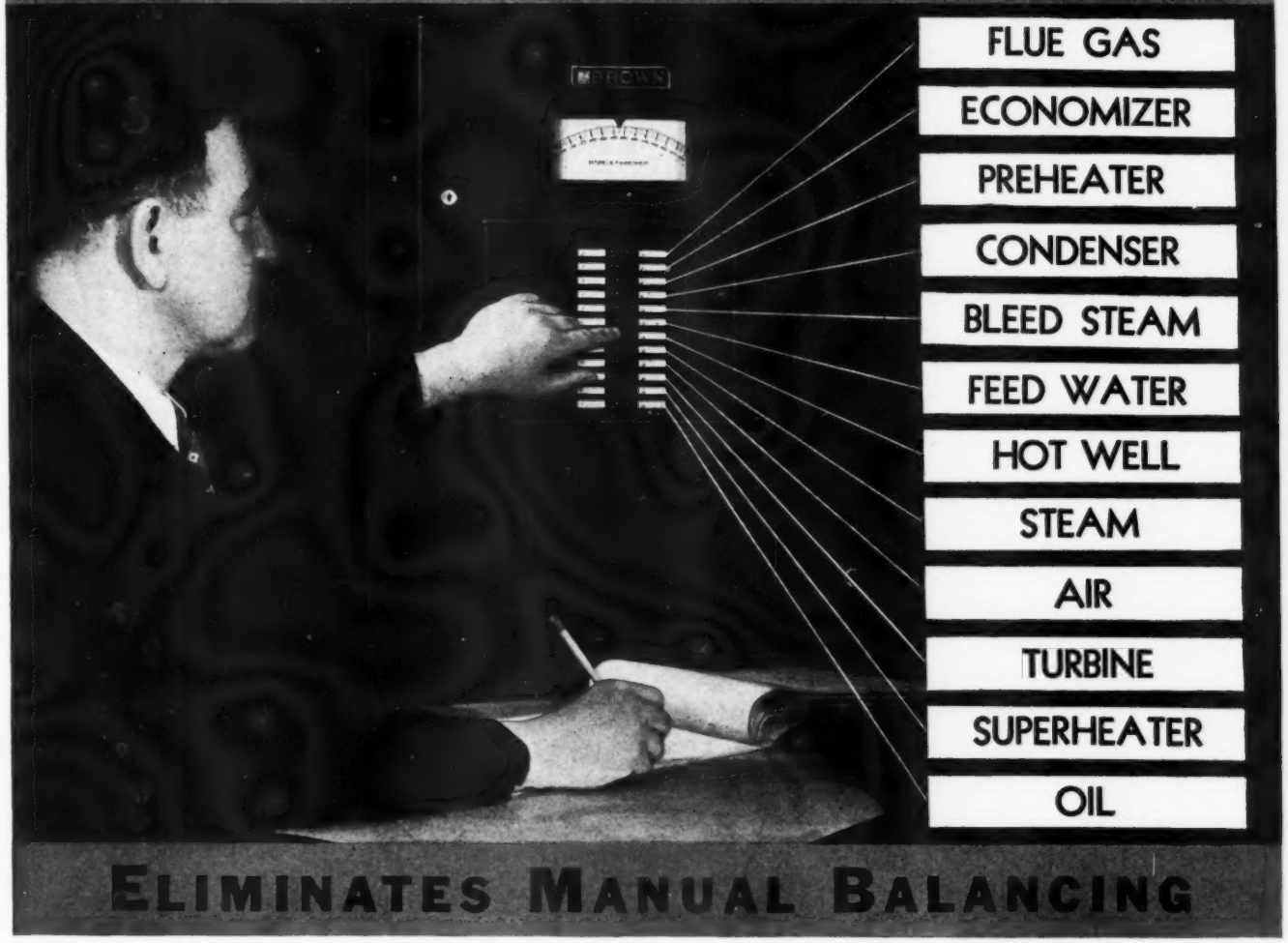
There's an OIC Distributor near you. You'll benefit by calling him today and by getting from him the full inside story of the cost-lowering advantages of OIC Valves. If you do not have his name we will be glad to supply it. Write direct to OIC—Wadsworth, Ohio.

**There's a superior OIC Bronze, Iron or Steel Valve in every size for every service.**

OIC VALVES

THE OHIO INJECTOR COMPANY -- WADSWORTH, OHIO, U. S. A.

# Check these Temperatures within a Few Seconds




## ELIMINATES MANUAL BALANCING

The self-balancing Centralized Reading Indicator pictured above is as modern as jet propulsion.

The operator merely touches the desired switch. The instrument does the rest, leaving his hands free to log readings.

Time required between readings is limited *ONLY* by human ability to pick off a reading. Compare this time to that required to read an outmoded *manual* balance indicator, designed when shaving mugs were on every barber shop shelf.

*The Brown Centralized Reading Indicator is unique for other reasons too.*

*The electronic "Continuous Balance" principle delivers sensitivity previously unheard of. Imagine being able to read one part in twenty-four hundred!*

*The ElectroniK is totally unaffected by vibration — mount it on a pulverizer frame if it suits your purpose.*

The ElectroniK utilizes circular instead of reciprocating motion. Components move only when the scale is changing position.

Specify the Brown Precision Indicator for that post-war boiler.

Specify it too, for your present station. Utilizing the same wiring and thermocouples, it readily replaces old-fashioned instrumentation.

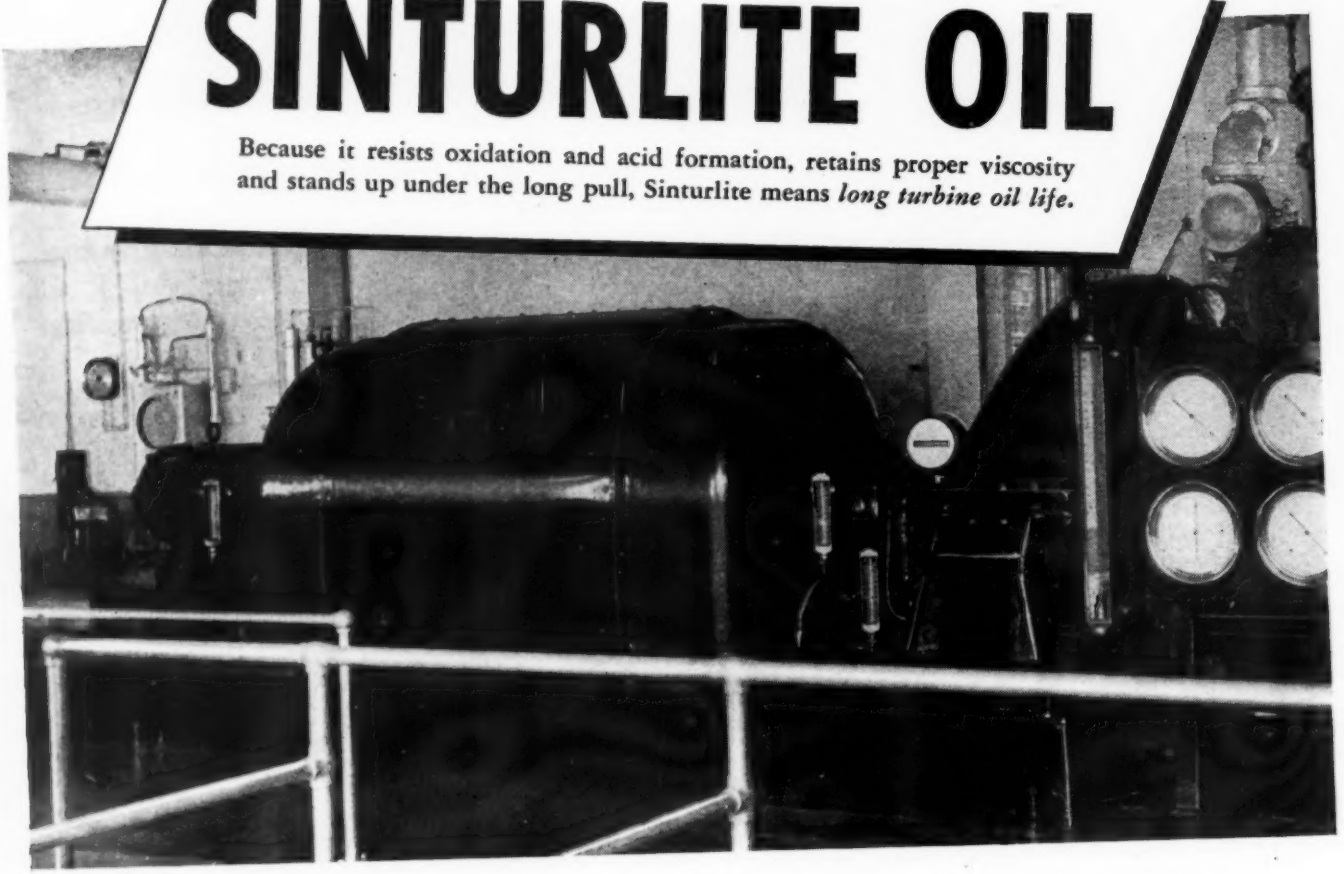
Write for Bulletin 15-4, THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Co., 4490 Wayne Avenue, Philadelphia 44, Pa. Branches in all principal cities. Toronto, Canada - Lonodn, England - Stockholm, Sweden - Amsterdam, Holland.

BROWN *Electronik* POTENTIOMETERS

# For L-O-N-G-E-R TURBINE OIL LIFE *in the grueling grind*

## SINTURLITE OIL

Because it resists oxidation and acid formation, retains proper viscosity and stands up under the long pull, Sinturlite means *long turbine oil life.*



HIGH SPEED turbines . . . operated continuously, day and night, month in and month out, meet a grueling grind. For proper lubrication, turbine oil must be constant in quality, capable of extended life. Sinturlite is made specially to stand up under all conditions in this long pull.

Non-foaming, non-corrosive Sinturlite provides lubrication that offers protection against expensive shutdown with interrupted power supply. Try Sinturlite for turbine lubrication problems.

**SINCLAIR INDUSTRIAL OILS**

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

# American industry flows through fairbanks valves

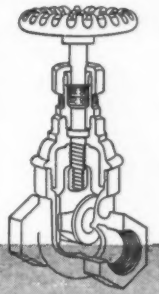
## STEEL... strength of a nation

Supplier of sinew for mighty war machines, steel means business from the first flares of its fiery birth. To the clang of giant hammers shaping it to man's use, steel as a metal and as an industry is piling up a year-after-year performance record that staggers imagination.

Steel is vital to our economy in a way no other material can parallel. And in no other field is the service of valves by the thousands more important to steadily-maintained high levels of essential production.

The large quantities of Fairbanks Valves used in the steel industry afford a striking example of what we mean when we say "American Industry flows through Fairbanks Valves." This wide line of bronze and iron valves is backed by more than fifty years of frequent advances in manufacturing . . . consistent improvements in materials.

Fairbanks Catalog Number 42 gives specifications, prices. If it's not in your files now, we suggest you write today. When we send it, we'll advise you of nearest distributor.



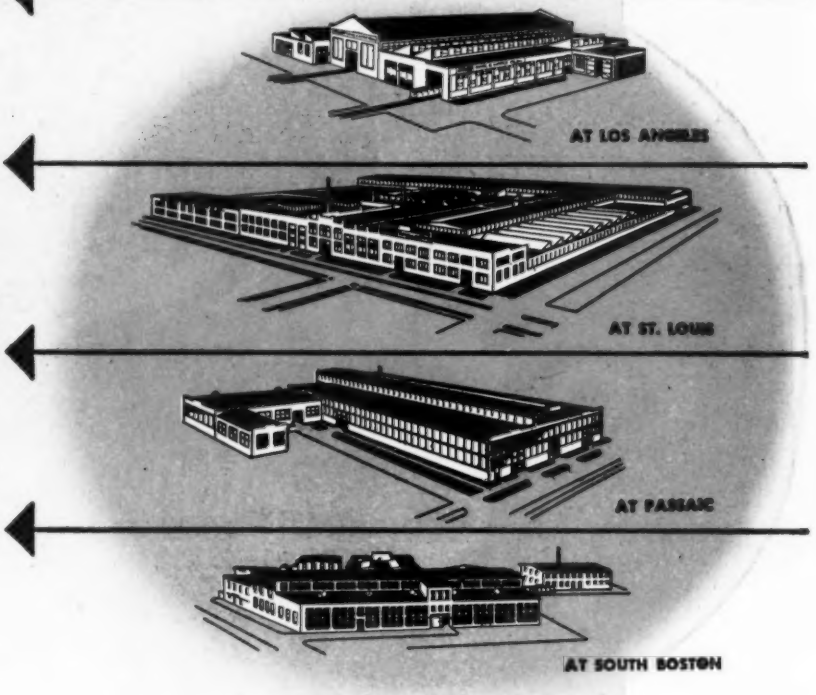
THE fairbanks COMPANY

393 LAFAYETTE STREET, NEW YORK 3, N. Y.

320 Atlantic Avenue, Boston 10, Mass. • 15 Ferry Street, Pittsburgh 22, Pa.

# TO THE USER OF FABRICATED PIPING

# 4 PLANTS *Are Better* THAN 1




There are four Midwest pipe fabricating plants located in different parts of the country, because Midwest has found that "four plants are better than one" for the user of piping.

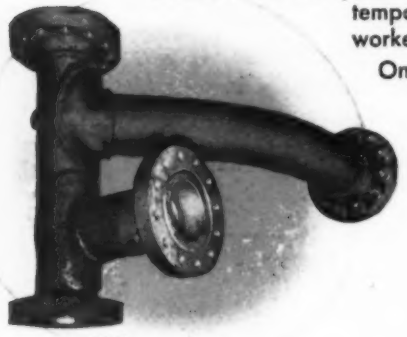
In addition to shortening shipping distances and making for a better understanding of the customers' individual problems, four plants provide other important benefits in which all Midwest Piping users participate.

Extra reserve capacity is provided for the emergency job. If extreme speed is sufficiently important, a job can be divided among two or more plants. An overload in one plant often can be handled by temporarily transferring skilled workers from other plants.

One of the greatest advantages is the continuous exchange of information and experience between staff members of the four plants. New techniques developed in one plant are made known to all. Piping problems which may be new to one plant probably are very familiar to another where the "know how" information is available at once. Friendly rivalry—constant study of piping problems by four organizations—tends to advance the art of piping fabrication much more rapidly than would otherwise occur.

All of this works to the advantage of piping users —four plants are better than one.

Midwest can give you better piping and better service . . . whether you need only a simple bend or the most elaborate piping job completely erected and ready for operation.



1527

**MIDWEST PIPING AND SUPPLY COMPANY, Inc.**

**Main Office: 1450 South Second Street, St. Louis 4, Mo.**
**Plants: St. Louis, Passaic (N. J.) and Los Angeles**
**Subsidiary: Lumsden & Van Stone Co., South Boston 27, Mass.**
**Sales Offices: New York 7—30 Church St. Chicago 3—645 Marquette Bldg.**
**Los Angeles 33—520 Anderson St. Houston 2—229 Shell Bldg.**
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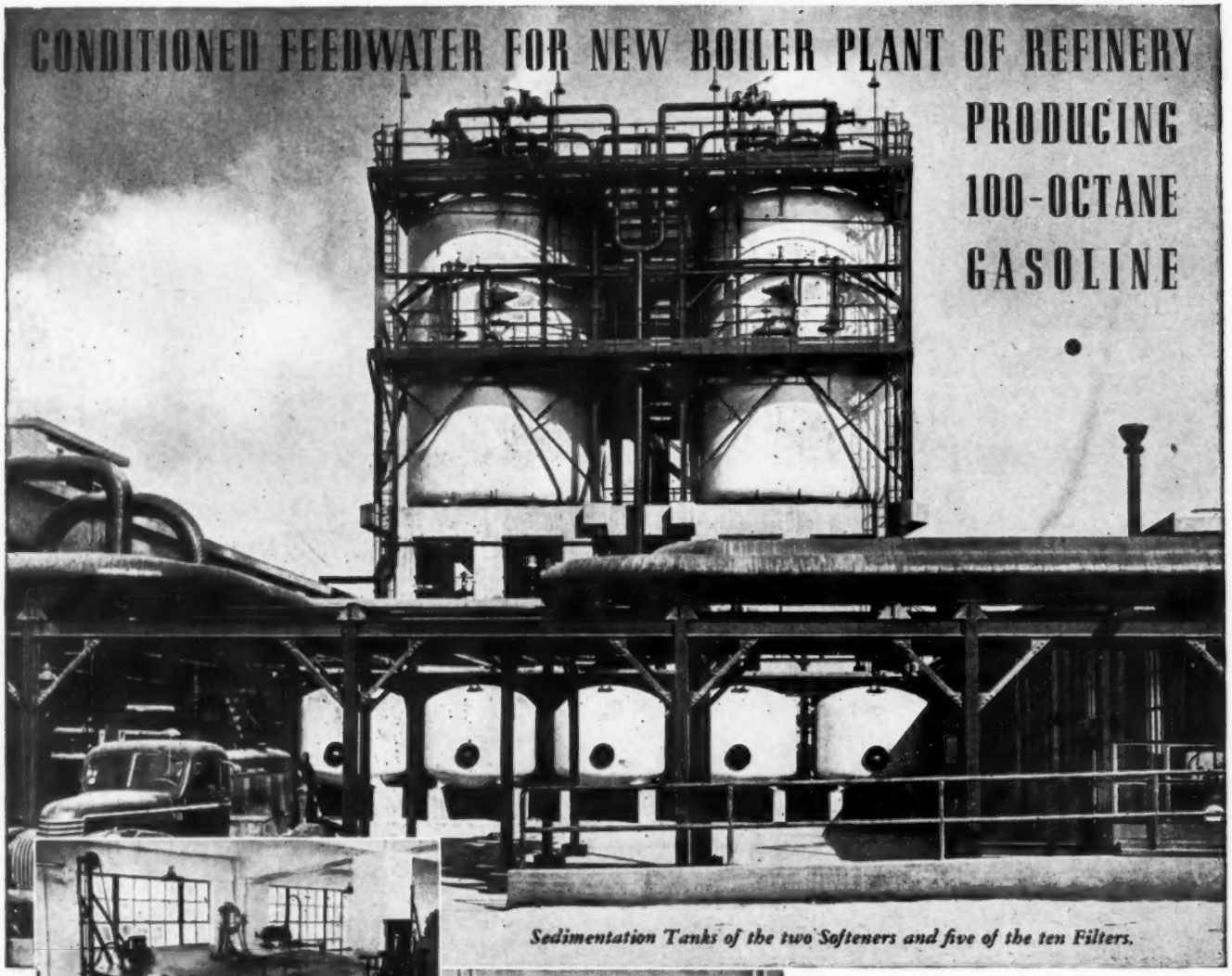
**PIPING FABRICATORS AND CONTRACTORS**

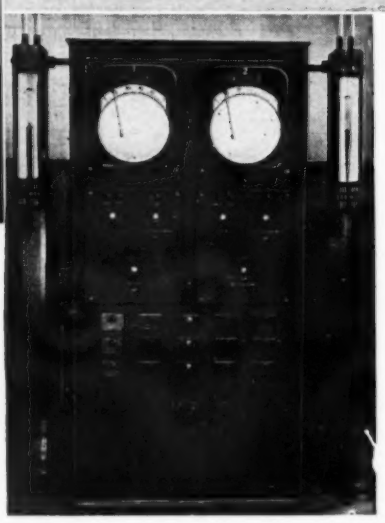
Photoelectric
FLAME-FAILURE
Safeguard
fireye
EXPLOSION PREVENTER
A flame failure safeguard must react instantaneously to provide full protection against the explosion hazard of flame failure.
Fireye is a photoelectric Flame Safeguard. It is actuated by the direct light of the flame itself. Fireye acts instantly on flame failure to cut off fuel and sound an alarm.
Thousands of industrial and U. S. Navy installations throughout the world testify to the superiority of this equipment.
ACTUALLY SEES FLAME
CONTINUOUS 24 HOUR PROTECTION
INSTANT FUEL CUT-OFF
MAINTENANCE FREE
EASILY INSTALLED
PROTECTED FROM RADIANT HEAT
WRITE FOR YOUR BULLETIN 102-C TODAY.
ELECTRONIC FEEDWATER CONTROLS
PHOTOELECTRIC FLAME MONITORS
COMBUSTION CONTROL CORPORATION
77 BROADWAY, CAMBRIDGE 42, MASSACHUSETTS

# CONDITIONED FEEDWATER FOR NEW BOILER PLANT OF REFINERY PRODUCING 100-OCTANE GASOLINE



*Sedimentation Tanks of the two Softeners and five of the ten Filters.*

*Above—Chemical Mixing Tank.*



*Right — Cochrane Flow Meter Panel Board for Automatic Control of Acid Feed.*

**AT one of the big California refineries now devoted to the production of 100-octane gasoline exclusively, the installation illustrated here, consisting of two 50,000 GPH, Cochrane Deaerating Hot Process Softeners, with ten 9′ dia. Filters, Mixing Tank, etc., supplies conditioned feedwater to the new high-pressure boilers. Many unique Cochrane features distinguish this installation, among which are a stirring mechanism which reduces turbidity to less than 5 ppm, automatic sludge blow-off, backwashing of filters with filtered water and panel board control of chemical feeds. • Write for complete details of this job or for a copy of Publication 3000, "Hot Process Softeners."**

**COCHRANE CORPORATION • 3106 N. 17th ST. PHILADELPHIA 32, PA.**

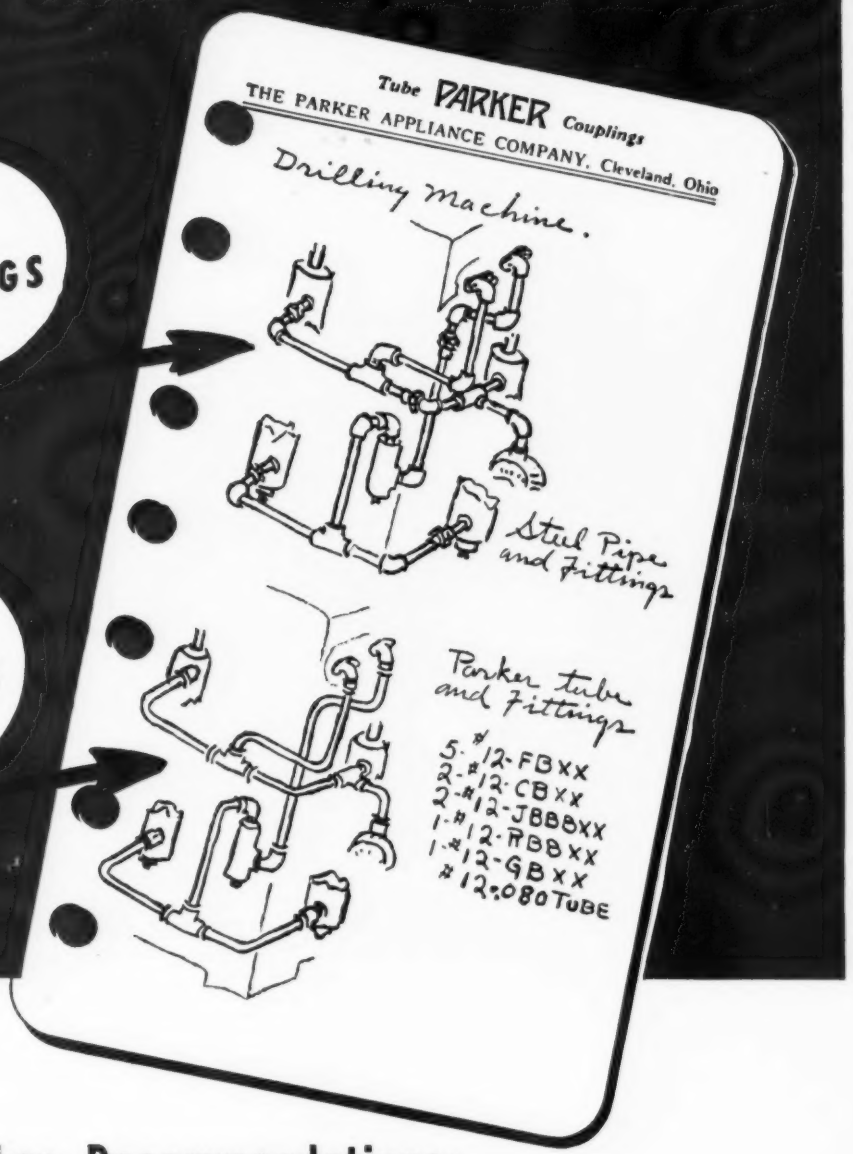
# COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

# PROOF FROM A PARKER ENGINEER'S NOTEBOOK

**22 PIPE FITTINGS**
OLD METHOD

**11 PARKER TUBE COUPLINGS**
RECOMMENDED PARKER METHOD



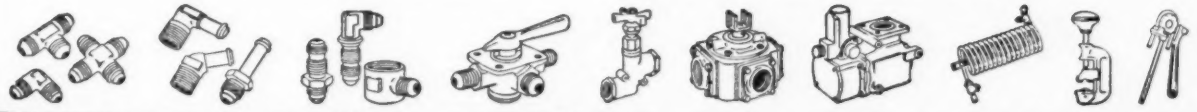

## Advantages of Parker Recommendations:

- Streamlined flow, free from obstructions. No pockets to cause turbulence. Less pressure drop; capacity and pressure requirements reduced.
- Fewer joints and connections — to reduce leakage, even under high pressure vibration, shock, fluid hammer, surge or accidental abuse.
- Compact, spacesaving, neat and simplified installation, especially in tight places — yet all parts are accessible for quick, easy installation and service.

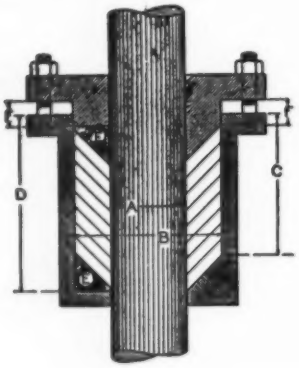
• • •

We've engineered Fluid Power installations for many people — to bring them these advantages, under a wide range of exacting conditions. May we do the same for you? Let's talk it over.

**THE PARKER APPLIANCE CO.**
CLEVELAND • LOS ANGELES



**FLUID POWER PRODUCTS FOR ALL INDUSTRY**



# Q-P Self-Setting PACKING

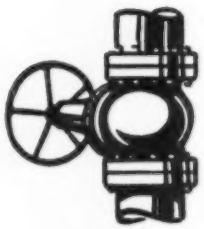
## PERFORMANCE-PROVED UNDER UNUSUAL OPERATING CONDITIONS . . . . . .

Q-P Self-Setting Packing has demonstrated its superiority under the most difficult conditions on land and sea and can be depended on to meet post war requirements for high maintenance economy. It is the ideal packing for superheated steam, saturated steam, hot and cold water, ammonia, fuel oil, compressed air, gases and acids and other operating conditions.

Q-P Self-Setting Packing is moulded to the exact diameter of the rod and stuffing box from various materials depending on the conditions involved. The smaller diameter of the ring or cone, always points toward the condition being sealed. Under pressure the lips of the packing are closed automatically against the rod and the side of the stuffing box with minimum friction, assuring a perfect seal without causing excessive friction or undue wear of rod or packing. Removal of pressure frees the packing from the rod.

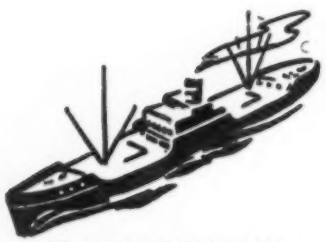
Q-P Self-Setting Packing is made in solid and split types to specified rod and stuffing box dimensions. Its proper installation assures longer packing life, infrequent tightening up of gland, and elimination of rod scoring. Outstanding savings in maintenance are a matter of record wherever *Q-P Self-Setting Packings* have been used.

***WRITE TO US AND OUTLINE THE SERVICE TO BE PACKED AND WE WILL SUPPLY THE PROPER PACKING***

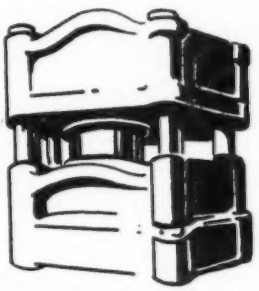


VALVES

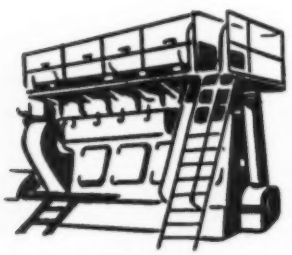
EXPANSION JOINTS



TELEMOTORS-VALVE



HYDRAULIC EQUIPMENT



DIESELS

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Chapman Industrial Supply Co., Los Angeles 13, Calif.
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A. G. Day, South Braintree 85, Mass.
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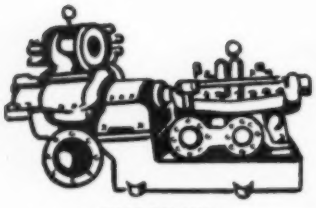
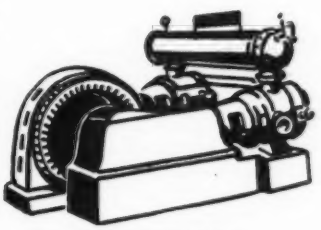


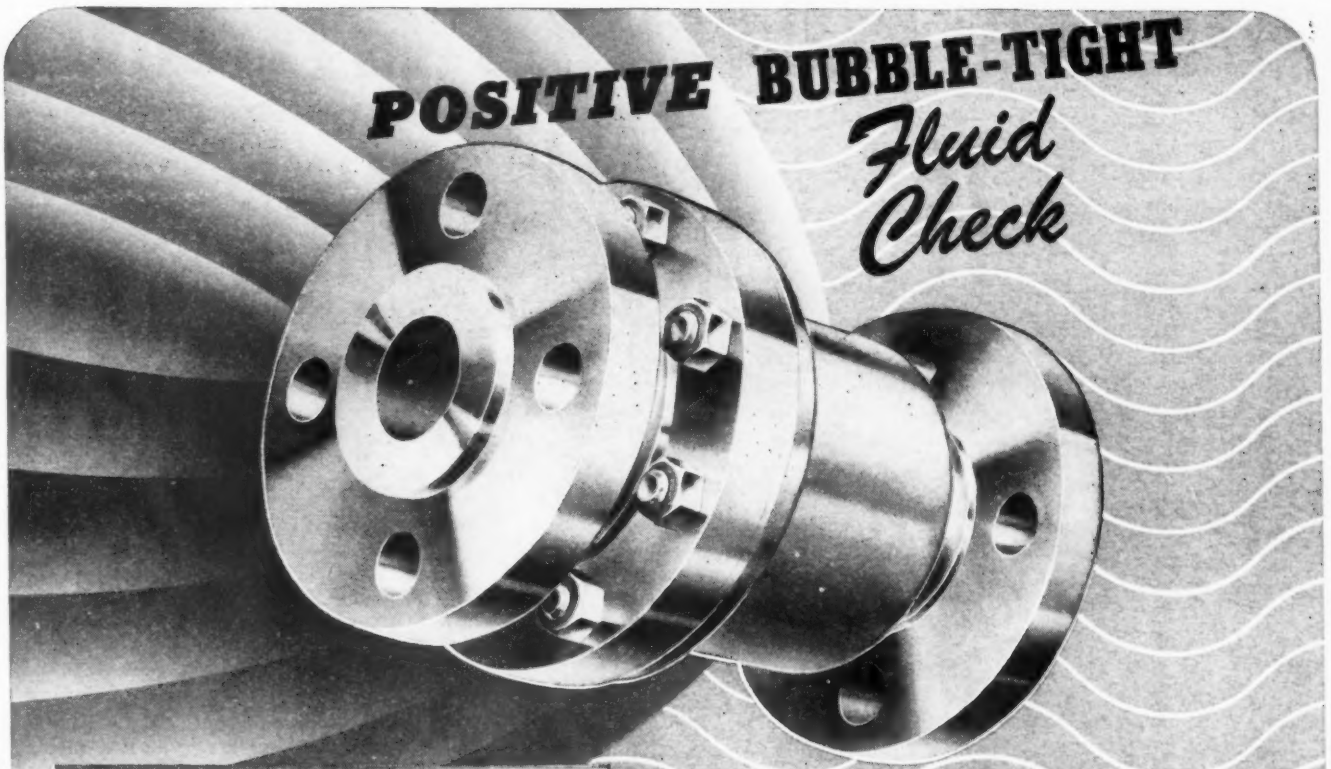
TURBINES

*The*
**Q-P MANUFACTURING COMPANY**
NEEDHAM HEIGHTS, MASS.

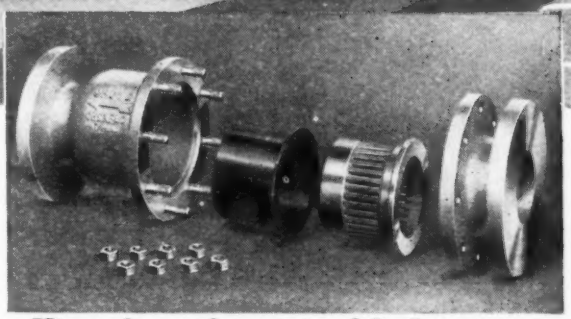


COMPRESSOR
(Ammonia)

# POSITIVE BUBBLE-TIGHT *Fluid Check*



**For AIR•GAS•LIQUIDS**



View above shows simplified parts assembly of Grove ChexFlo Valves consisting of: 1. Valve Body, 2. Flexible Synthetic Rubber Tube, 3. Slotted Cup-shaped Core, 4. Flange Closure.

- ★ Positive Bubble-tight shut-off
- ★ Instantaneous in Operation
- ★ Closes on Balanced Flow
- ★ Avoids Pressure Impulses
- ★ Self-compensating for Wear
- ★ Requires no Maintenance
- ★ Silent in Operation

## EMBODIES NO METALLIC MOVING PARTS

Contrasted to ordinary check valves the Grove Chex-Flo employs no metallic moving parts. Operation is effected by means of a synthetic rubber tube which expands to open and contracts to close over a slotted cup-shaped metal core. Uniform and constant spring rate of the flexible tube sets up no inertia to cause operation in excess of flow requirements. Tube closes instantly on balanced flow prior to inception of back flow. This eliminates any tendency to establish pressure impulses, shock or water hammer in flow line. For full details write for Bulletin 610 today.

# GROVE *CHEX-FLO* MODEL 60 CHECK VALVES

GROVE REGULATOR COMPANY

65th & GREEN STREET, OAKLAND 8, CALIFORNIA • *Eastern Sales and Export Office:* 30 Rockefeller Plaza, New York City

*Factory Branches:* 108 Portwood, Houston, Texas • 1930 West Olympic Boulevard, Los Angeles 6, California

# REDUCE THAT POWER "WASTE-LINE"

# MODERNIZE WITH TODD BURNERS!

IN MANY plants there is a "waste" that has gone unrecognized, year after year — a waste of fuel caused by inefficient combustion.

Today — when a reduction in operating costs can be an important element in holding down prices to meet competition — more and more plant managers are turning a critical eye upon their heat and power set-ups.

When you modernize your boiler room with Todd Oil or Gas Burners, you lay a solid foundation for heat and power economy.

Todd Burners — in case record after case record, which our engineers can show you — have cut fuel consumption as much as 10%, *or more.* At the same time power *capacity* was greatly stepped up and maintenance costs held to a minimum.

A Todd engineer will help you trim that power "waste-line." Many standard and modified types of Todd Burners are available and each job is individually engineered to provide the right application for the heat and power requirements of any industrial or commercial installation.

**COMBUSTION EQUIPMENT DIVISION**
**TODD SHIPYARDS CORPORATION**
**601 West 26th Street, New York 1, N. Y.**

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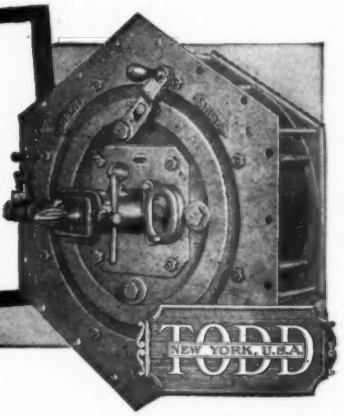


# WANT GREATER SAVINGS IN COAL-HANDLING?

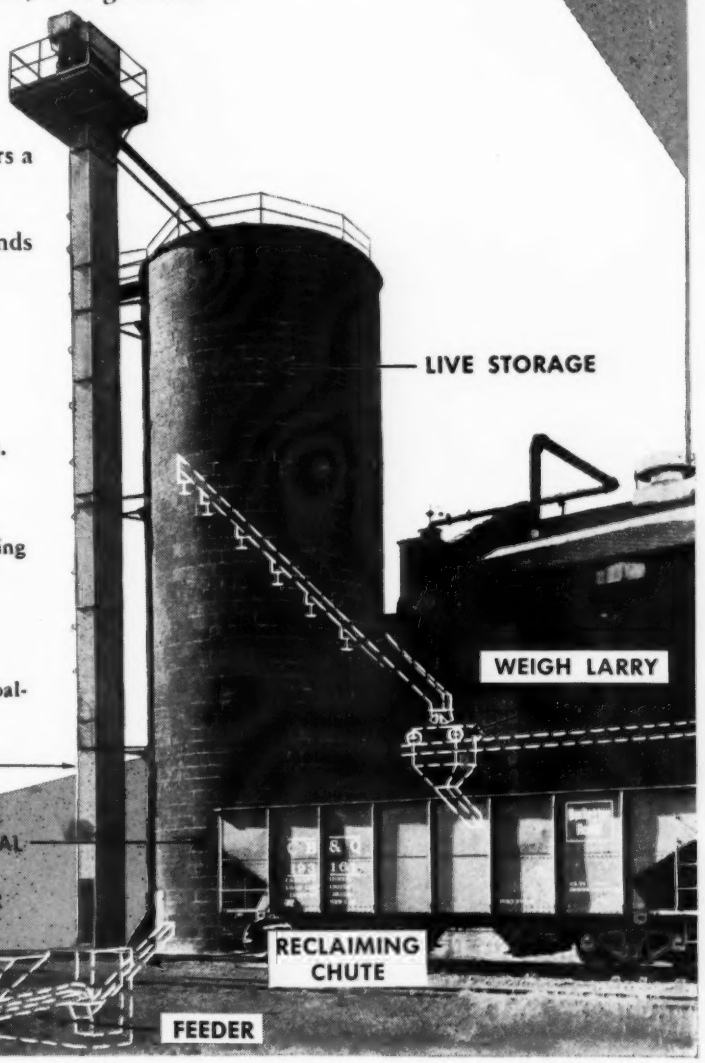
## give the whole job to G-W

There are good, sound *reasons* why coal- and ash-handling problems are so frequently *solved at a saving* when Gifford-Wood is called in at the start.

Number one: G-W takes *all* the details of design, manufacture, and erection completely off your shoulders. With responsibility centered in G-W, there are fewer "conferences"—with fewer people—to take up your time. Less of your equipment dollar goes into outside pockets, more goes into coal-handling efficiency in your plant.

G-W has been specializing in this *complete service* for 130 years. That experience—evident in hundreds of G-W installations—saves you money, too. And G-W *advice* covers a wide range of applications—for G-W designs and builds material-handling equipment of *all* popular types. The system G-W recommends for you is based on one thing: your needs, as revealed by a thorough study of your plant conditions. Gifford-Wood Co., 420 Lexington Ave., New York 17, N. Y.; 565 W. Washington St., Chicago 6, Ill.—Factory: Hudson, N. Y.
Let a G-W engineer call and consult with you. Just write Dept. P.

Illustrated is an installation of *standard* G-W equipment co-ordinated into a handling system meeting *specific* requirements—the moving of coal, mechanically, from track hopper to storage, thence to boiler room. Your problem may be similar—or it may call for special equipment, which G-W also designs and builds. Either way, there are good reasons why a G-W system may give you greater coal-handling efficiency at lower cost.




**HANDLING HEADQUARTERS** for Industrial Conveying and Elevating Equipment . . . for Coal and Ash Handling Equipment . . . for Ice Handling Tools and Ice Processing Machines . . .

**G-W HANDLES IT . . .**
**faster • easier • cheaper**

**GIFFORD-WOOD**
SINCE 1814

# MAINTENANCE COSTS SOARED BECAUSE OF MANY POWER DRIVE FAILURES

*then installation of a*

## DAYTON V-BELT DRIVE ELIMINATED BREAKAGE

### and paid for itself in 3 months

Driving this pulp beater is a tough job and the original drive couldn't take it . . . broke frequently. Then 13 Dayton V-Belts were put to work, utilizing the existing large flat pulley. They have operated continuously without any breakage. Not only did the savings in belt costs pay for the Daytons in three months time, but additional important savings resulted because production is not now interrupted. Dayton V-Belts correct such power transmission drive difficulties easily because they are engineered for their job as a result of 40 years of experience working with natural and synthetic rubber. They can help to solve your power drive problems just as easily. Write for full information today.

**THE DAYTON RUBBER MANUFACTURING COMPANY**
DAYTON 1, OHIO

★

**ATTENTION POWER TRANSMISSION ENGINEERS:**

There is a mill supply house near you that stocks Dayton V-Belts. Look for the name under the trade name listing, "Dayton V-Belts", in the yellow pages of your telephone book.

★

**SEND FOR YOUR COPY OF THIS DAYTON CATALOG:**

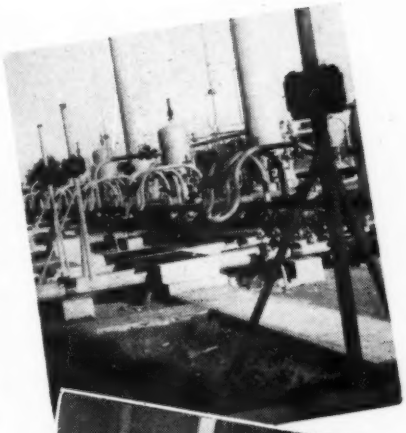
With a Dayton No. 280 Catalog you can quickly and easily select the V-Belt requirements of any power transmission drive. Your copy is free. Write for it today. The Dayton Rubber Mfg. Company, Dayton 1, Ohio.

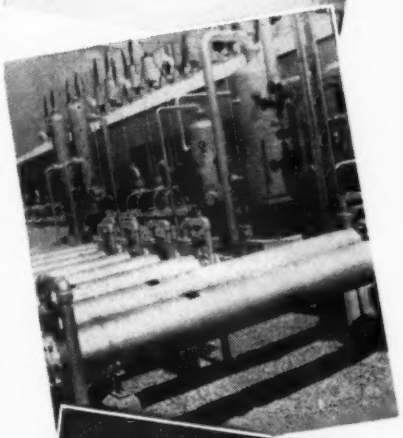
**Dayton Rubber**

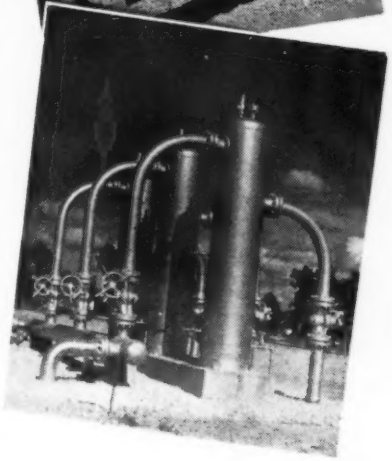
THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

# NEW B. S. & B. SAFETY HEAD CATALOG

## *Now In Preparation*







## Write Today for Copy of This FREE CATALOG

*It Tells . . . .*

**Where to Use SAFETY HEADS**

**When to Use SAFETY HEADS**

**How to Use SAFETY HEADS**

B. S. & B. SAFETY HEADS are now in use in most of the large industrial plants protecting pressure vessels. If you are not using SAFETY HEADS in your plant you will find this new catalog very helpful in planning your safety factors. Write today and we'll put your name on the list to receive this new catalog when ready.

## BLACK, SIVALLS & BRYSON, Inc.

7500 E. 12th Street

Kansas City 3, Missouri

# SCIENCE ASSURES UNIFORMITY and QUALITY

**GLOBE STEEL TUBES ARE AVAILABLE IN:**

- Carbon Steels
- Alloy Steels
- Stainless Seamless
- Stainless Welded (Gloweld)
- Special Analyses
- High Purity Iron (Globeiron)
- High Ductility
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- Annealed
- Cold Drawn
- Pressure
- Condenser and Heat Exchanger
- Mechanical
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- Aircraft
- Automotive
- Locomotive
- Structural
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- Round
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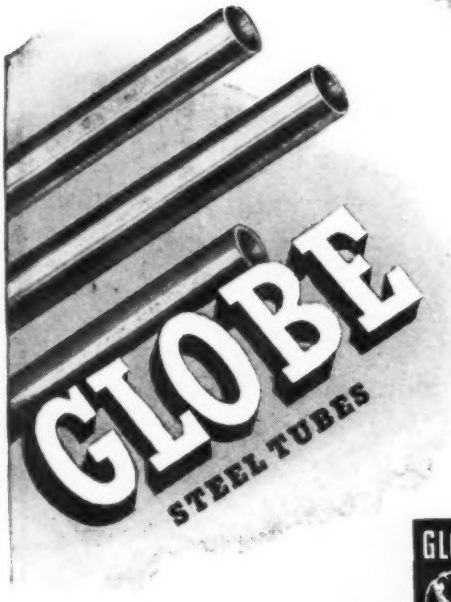



5023

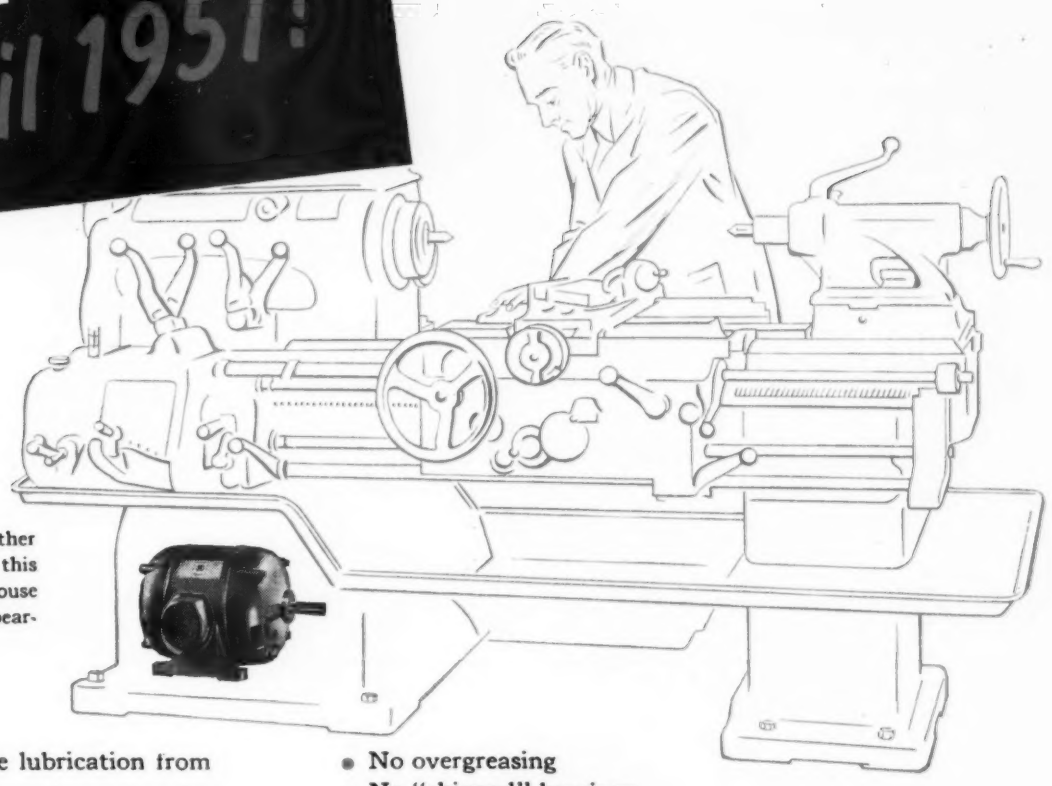
WE can trust our trained eyes, bank on our long years of experience, and produce good tubes. But science — as applied through exact laboratory control of material and production — brings us closer to perfection, so, we make full use of science with its most up-to-the-minute instruments in all of our steel tube making operations. The uniformity and quality of Globe Steel Tubes is closely guarded by Globe's "House of Science" — complete chemical and physical laboratories, manned by engineers, metallurgists, and technicians who have long specialized in steel tube production.

Close cooperation with all Globe customers is also part of the picture. Whatever your tube requirements may be, specialized knowledge and skill helps to provide exactly what you need. It's a practical, profitable, scientific approach to steel tube problems — the plus you get when you specify Globe Steel Tubes.

GLOBE TUBES

## GLOBE STEEL TUBES CO. MILWAUKEE 4, WISCONSIN, U.S.A.

# MOTORS YOU CAN FORGET *until 1951!*



*Until 1951*, don't even bother to look at the bearings of this motor—if it has Westinghouse prelubricated, sealed ball bearings.

When you eliminate lubrication from the maintenance program for motors for a period of 5 years or more, they require practically no attention whatever—and this is now true of Westinghouse squirrel-cage motors up to 20 hp, frames 203 to 326 inclusive.

The prelubricated, sealed ball bearings available only in Westinghouse motors in Types CSP and CS, need not even be inspected until after they run 5 years or more. They have run in operation tests for longer periods than this, bringing large savings in maintenance costs as well as other advantages—

- No overgreasing
- No "skipped" bearings
- No grease contamination
- No grease seepage
- No unreplaced pipe plugs

With this freedom from frequent lubrication, a far greater freedom is permitted design engineers and plant layout engineers. They can now place motors advantageously for efficient operation—unhampered by questions of accessibility and ease of greasing. For further details, write for Bulletin B-3554 and Descriptive Bulletins 3100-CSP and 3100-CS-1, to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-21376

**Westinghouse**

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

*Squirrel Cage Motors*

Prelubricated, sealed ball bearings are available in Types CSP and CS Motors up to 20 hp.

Another Westinghouse "first"—this label identifies motors that you "don't lubricate for 5 years or more"

# Power Economy with Long Life

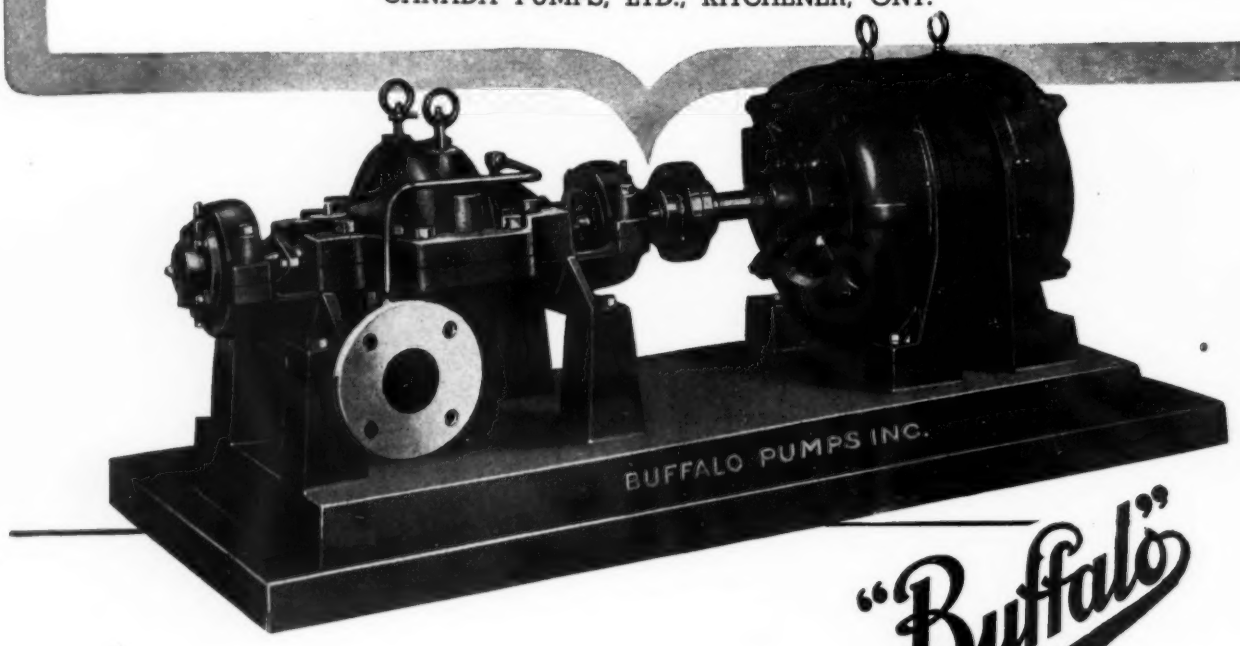
For Boiler feeding and general service work, the Buffalo Type "RR" Pump is ideal. Built in two and four-stage models, the Type "RR" has single-suction impellers mounted back-to-back so that nearly perfect hydraulic balance is obtained. Heavy-duty construction is a feature of this design, all parts are of generous proportions so that continuous operation may be expected.

Type "RR" Pumps are efficient, too, since actual operating efficiencies run above 75%.

If you need a pump to handle clear water on continuous operation—have economy of operation plus reliability with a Buffalo Type "RR" Pump. Bulletin 980 contains complete data.

## Buffalo Pumps, Inc.

488 Broadway Buffalo, New York
CANADA PUMPS, LTD., KITCHENER, ONT.




"Buffalo"

TYPE "RR"

## CENTRIFUGAL PUMPS

# SIVYER STEEL CASTINGS

*for all*

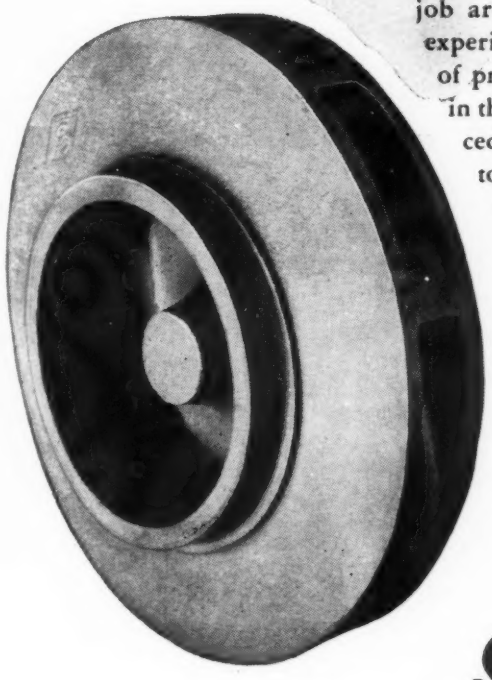
**CORROSION**

**HEAT**

**WEAR-RESISTANT**

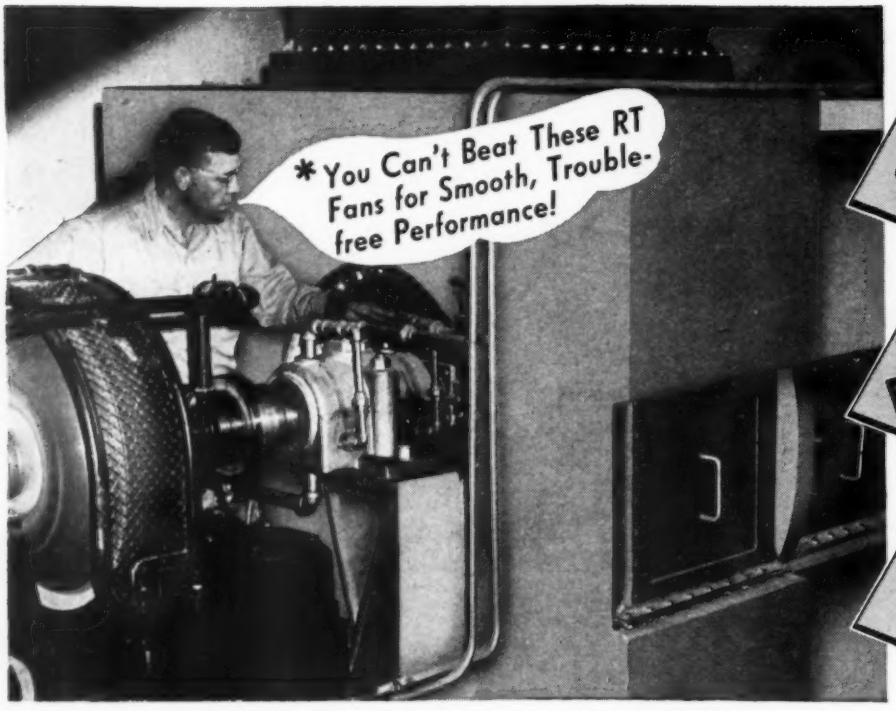
*requirements*

• If your casting requirements involve strength at elevated temperatures, resistance to oxidation and corrosion—see Sivyer. Here, no matter how diverse your needs, you'll find castings of greater integrity of metal that will reward you with longer, more dependable service. Behind every job are nearly 37 years of steel casting experience—"know how" in every step of production. This skill works for you in the careful planning of castings procedure . . . in modern, scientific laboratory testing and control . . . in correct foundry methods . . . in finishing for greater dimensional accuracy. Altogether it means—castings that get to your job faster, stay there longer. Let Sivyer help in the planning and design of your next corrosion-resistant castings.



**SIVYER STEEL CASTING COMPANY**

MILWAUKEE CHICAGO




SHAFT - Extra Large

BEARINGS - Extra Large

WHEEL - Extra Heavy

*This RT is operating as an induced draft fan (central station job) handling flue gases at 400° F.

# WANTED! — a Chance at Your Tough Air Handling Jobs!

You can push Clarage Type RT Fans to the limit — and not be afraid of costly shutdowns or excessive maintenance.

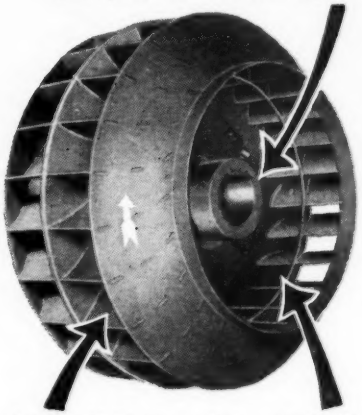
These RTs are designed to take stresses beyond common practice — built to be champions in the heavyweight class. Shaft and bearings are extra large; wheel extra heavy.

Use RT Fans for mechanical draft — especially induced draft. They are modern high-speed type — ideal for direct motor drive. In thousands of central stations and industrial power plants, they are proving their absolute dependability year after year.

*However, mechanical draft is not all! Also use Clarage RTs in connection with industrial processes, wherever air must be handled at high temperatures or high pressures, or both — and where the going is not only tough, but too important to let a boy do a man's job. Wide range of sizes to meet a wide range of needs.*

May we furnish you with complete data on this extraordinary fan equipment?

The RT wheel hub is cast iron or steel, accurately machined to both sides of center plate. No brace rods required

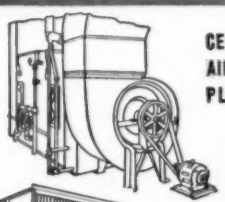


One-piece blades are inserted through slots in center plate and welded in place. The resulting smooth surfaces are far less subject to erosion.

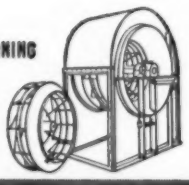
Blades, curved forward at the heel, are held rigidly by means of this heavy reinforcing band. No deflection takes place at high tip speeds.

SOME OF OUR OTHER PRODUCTS

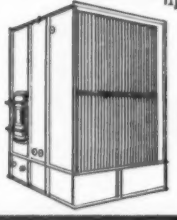
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



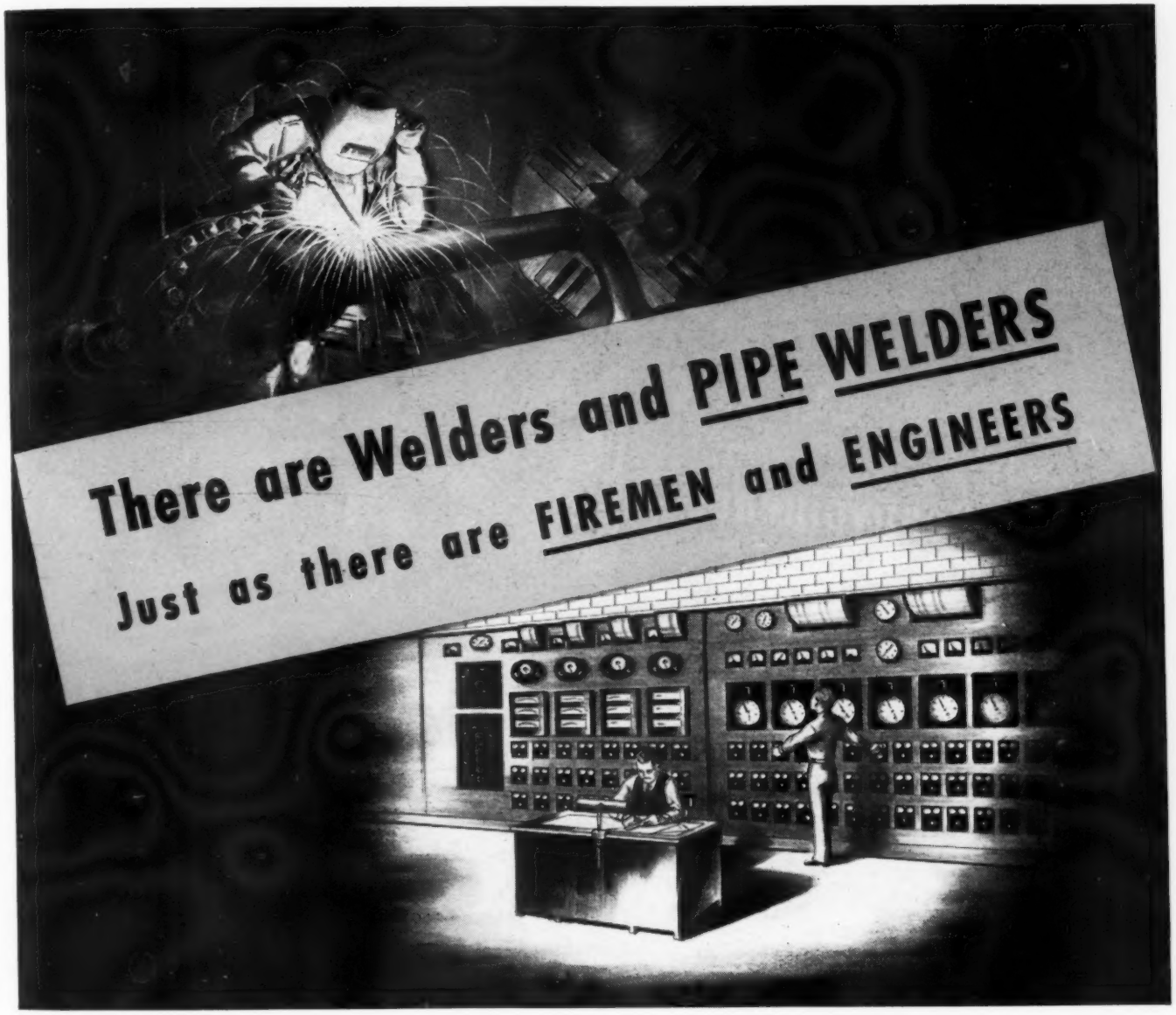
AIR WASHERS

**CLARAGE**

**FAN COMPANY**

Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES




A fireman or water tender serves a useful purpose . . . we couldn't get along without him. But he isn't an engineer. The engineer must have training and experience which the other man has not yet acquired. Many men are satisfactory firemen or water tenders who do not have the special aptitude to become good engineers.

Ordinary welders may be capable enough for ordinary work . . . but they aren't pressure piping welders. Operators capable of welding pressure piping must have special aptitude, careful training and plenty of experience. They must be painstakingly qualified in different positions and tested on procedures for various classes of materials.

Welders of these abilities are not easy to find . . . particularly in times of heavy demand for skilled labor. Pipe fabricators employ large numbers of qualified pressure piping welders. These welders work under the most favorable conditions and are closely supervised to make certain they exactly adhere to predetermined welding procedures that have proved correct for the particular job. Their work meets the most exacting standards . . . piping so fabricated is insurable.

Purchase of pré-fabricated piping from qualified fabricators is the best and most economical way to obtain quality pressure piping.

P.F.I.
THE PIPE FABRICATION INSTITUTE

THE PIPE
FABRICATION INSTITUTE

*Devoted to the Technical and Economic Problems in Piping*

1108 CLARK BUILDING • PITTSBURGH, PA.

F-10

# Mr. Pennypincher Has a Rival In MASON No. 11 Reducing Valves

When it comes to controlling steam pressures, you'll find that Mason No. 11 reducing valves provide accurate, dependable pressure control under all conditions normally encountered. Their sturdy construction and simple operating mechanism not only save you money by reducing waste but provide long life and cut maintenance costs as well.

Write for Catalog 75. It gives complete information on the Mason No. 11 as well as other types of Masoneilan reducing valves and regulators.




**MASONEILAN STRAINERS**

**Prevent scale, dirt chips, etc. from damaging regulator, traps, valves and pumps with Masoneilan strainers. They eliminate maintenance delays and save money.**

## MASON-NEILAN REGULATOR CO.

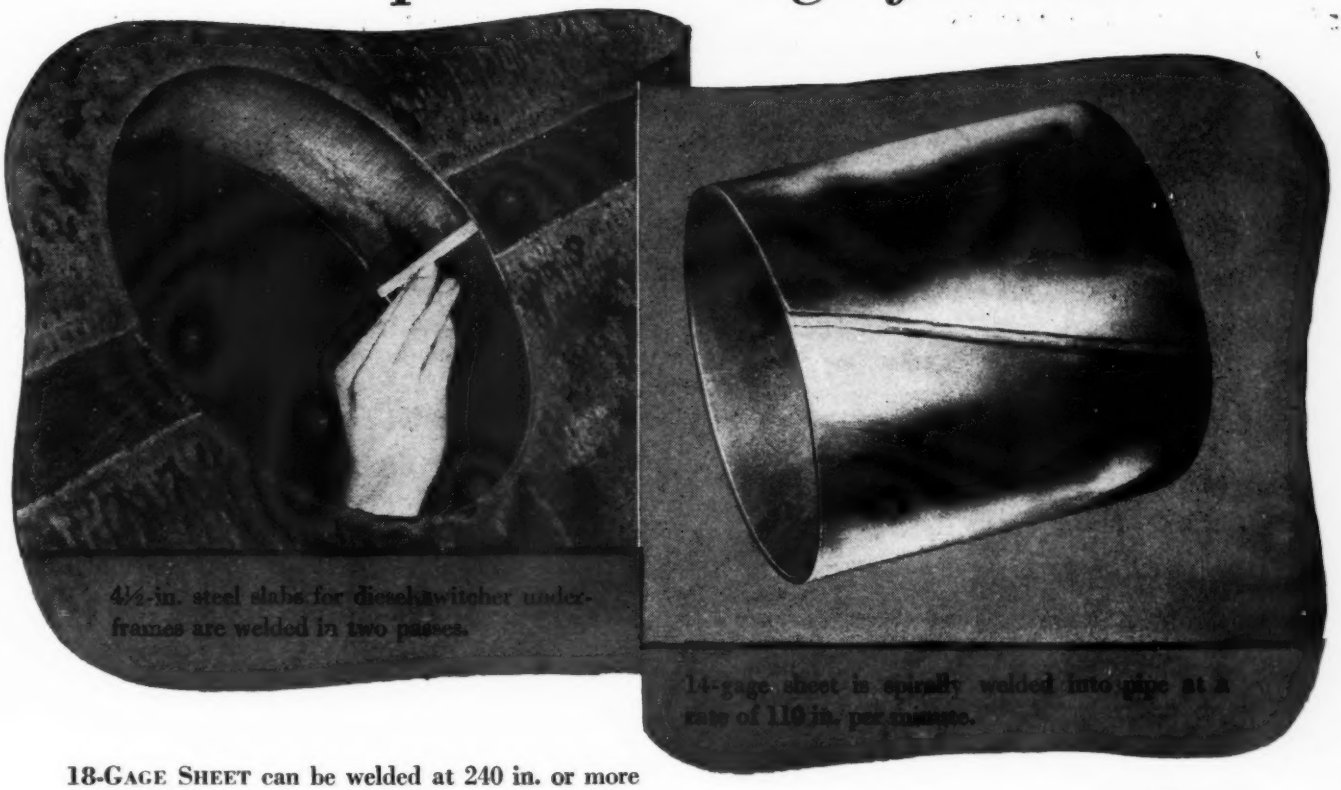
**1186 ADAMS STREET, BOSTON 24, MASS., U. S. A.**

MASONEILAN

New York Philadelphia Pittsburgh Cleveland Chicago Tulsa Atlanta
St. Louis Houston Los Angeles San Francisco Mason Regulator Co. of Canada, Ltd., Montreal, Canada

P. O. 7328

# *Linde's* UNIONMELT WELDING PROCESS
## *Speeds Joining of Metal*



4½-in. steel slabs for diesel-switcher underframes are welded in two passes.

14-gage sheet is spirally welded into pipe at a rate of 110 in. per minute.

**18-GAGE SHEET** can be welded at 240 in. or more per minute.

**ONE-PASS WELDS** even 3 in. thick can be made.

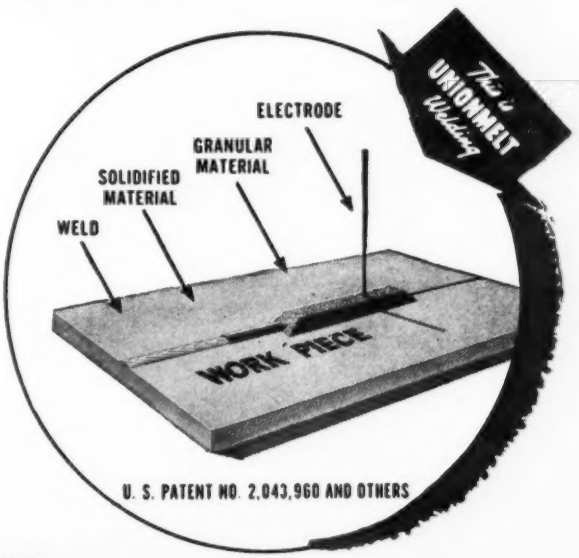
**WELDING CURRENTS** up to 4,000 amperes or more, a.c. or d.c. can be used.

**BUTT, TEE AND LAP FILLETS,** plug and molded welds can be made.

**MINIMIZED DISTORTION** is a result of high speed, narrow weld zone, and concentrated heat.

**NO METAL LOSS** from spatter or vaporization is encountered.

Anyone who wishes to use this patented invention may do so under Linde's standard license agreement. Send for a copy of the new **UNIONMELT** book, Form 6077.

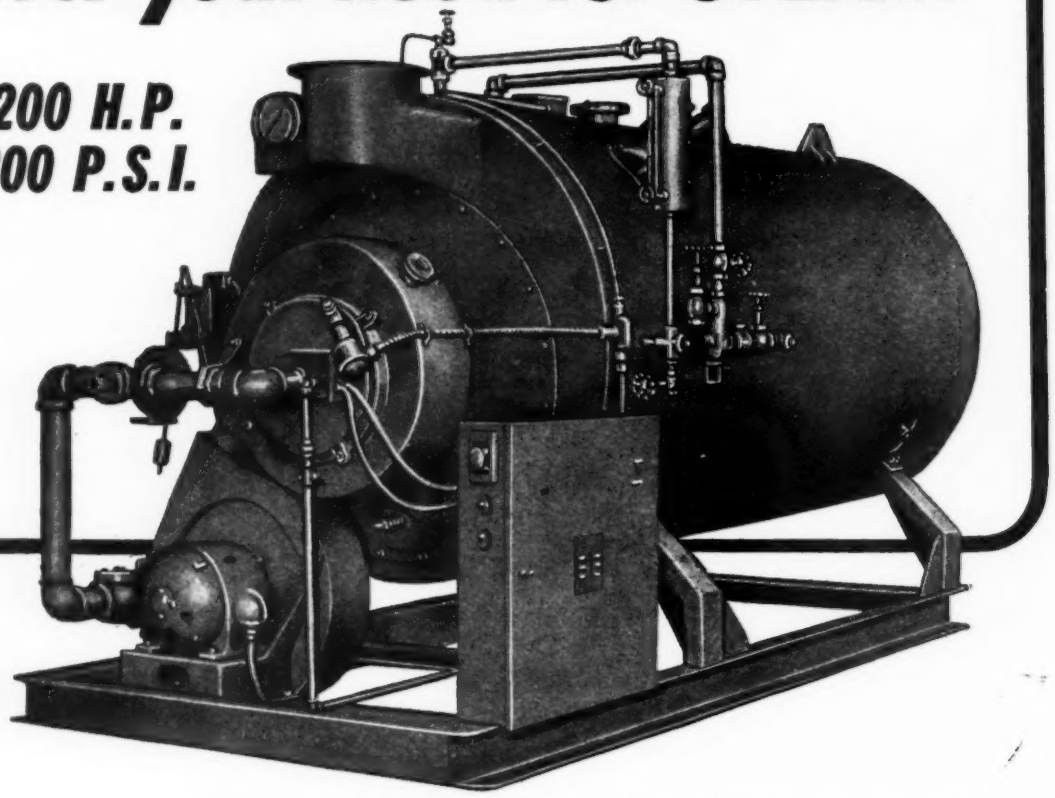



The word "Unionmelt" is a trade-mark of The Linde Air Products Company.

**THE LINDE AIR PRODUCTS COMPANY**
*Unit of Union Carbide and Carbon Corporation*
30 E. 42nd St., New York 17, N. Y. Offices in Other Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

# Whatever your need for STEAM

## up to 200 H.P.
## up to 200 P.S.I.



100 HP Cyclotherm Steam Generator — natural gas-fired with modulating controls

## THERE IS A CYCLOTHERM TO PROVIDE IT

### *automatically — dependably — at low cost*

Compare the Cyclotherm Steam Generator with any other make and you'll see why Cyclotherm is the choice of "experience-wise" steam users.

- *Maximum Operating Efficiency*—Operating efficiency of Cyclotherm Generator unit will be not less than 80%.
- *Gas Firing*—Cyclotherm units may be fired with Manufactured, Mixed, or Natural Gas. Completely automatic operation for all sizes.
- *Cyclotherm Burner*—Specially designed, "built-in", integral component of steam generator unit—Provides complete combustion with rapid, evenly distributed heat transfer—Fires any liquid or gaseous fuel.
- *Cyclotherm Combination Burner*—Fires oil or gas; change-over from one fuel to another by merely throwing a switch.
- *Wide Range Modulation*—Firing rate modulates automatically from 30% to 100% of full load in response to steam demand, sizes 80 to 200 HP.—Oil or gas operation.
- *Fully Automatic Heavy Oil Operation*—Cyclotherm units 80 to 200 HP.
- *Fits in Small Area*—More compact and space saving—Favorable "go thru" dimensions.
- *Single Responsibility*—One manufacturer to deal with. Cyclotherm units shipped complete with boiler, burner, all controls and accessories assembled, fully piped and wired, test fired for performance, ready to operate on arrival.
- *Performance Record*—Thousands of Cyclotherm units performed all over the world with our armed services. Their record of efficient duty is your guarantee of the engineering "know-how" and experience built into each unit.

*Write, wire or phone for more complete information.*

## CYCLOTHERM STEAM GENERATORS

**CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 502, NEW YORK 4, N. Y.**

Gilmer
ENDLESS MULTIPLE V-BELTS
Surpass in all three basic belt requirements
GRIPPING POWER. As Gilmer Multiple V-Belts flex around sheaves, the sides tend to push outward, hugging groove walls with a non-slip grip . . . yet releasing smoothly and easily the instant belt straightens out.
PULLING POWER. Each belt bears its full share of the load, for all are precision molded, assuring "matched" lengths to within very small tolerances. Stretch is controlled by the pre-conditioned, reinforced, multiple-strand plies in the load-pulling section.
LASTING POWER. Gilmer Multiple V-Belts stand up long and strong in service. The tough, heavy jackets are designed for the most rugged service, and all elements are firmly bonded to eliminate internal friction and heat.
Gilmer Multiple V-Belts are supplied in all standard and many special sizes . . . also in belting rolls of 250 and 500 feet. When desired, belts are specially manufactured to withstand conditions of excessive oil, heat, static, etc.
Write for a FREE copy of the Gilmer Guide, the most complete V-Belt Catalog ever published. Contains valuable data that will prove helpful to every power plant engineer and factory manager.
Gilmer BELTS
There are Gilmer Belts for every power transmission need.

## L. H. GILMER COMPANY

Tacony, Philadelphia 35, Pa.

DIVISION OF UNITED STATES RUBBER COMPANY

"Trifles make perfection but perfection is no trifle"

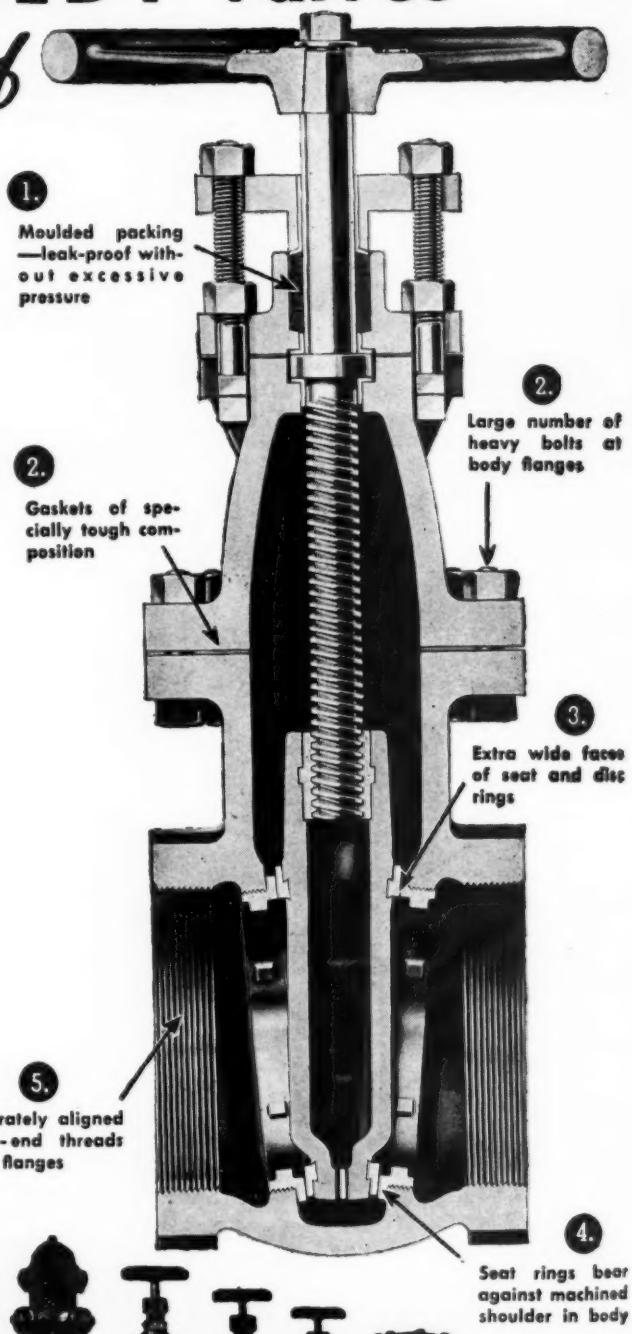
One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.

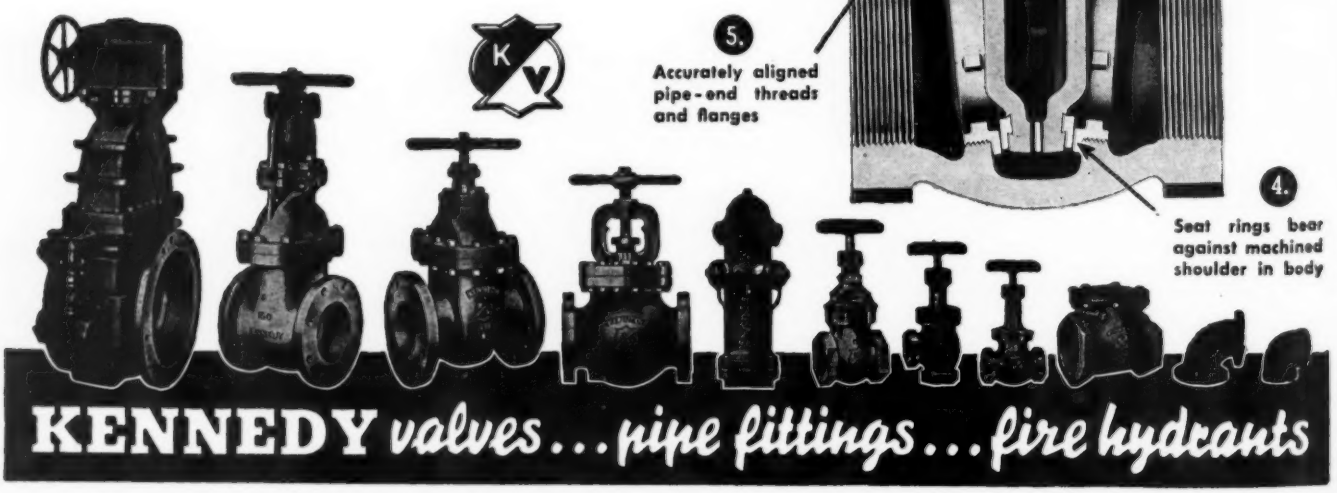
# 5 Features that make KENNEDY valves lastingly leak-proof

1. LEAK-PROOF at the STUFFING BOX . . . without excessive friction . . . because of accurately fitting glands, stems and bushings with moulded packing.
2. LEAK-PROOF at BODY-BONNET JOINT . . . because of gaskets of specially tough composition and large number of heavy bolts at body flanges.
3. LEAK-PROOF between DISCS and SEATS . . . because of extra wide faces of seat and disc rings, with accurate machine work and rigorous factory tests.
4. LEAK-PROOF between SEATS and BODY . . . because seat rings are securely screwed into body and bear tightly against shoulder in body.
5. LEAK-PROOF at END CONNECTIONS . . . because of accurately aligned pipe and threads and flanges.

Lasting tightness is but one of the many details to which Kennedy gives extra care . . . and extra value . . . in valve design and construction. The Kennedy Catalog describes all these special features and will help you make a selection for trial. Your copy sent on request.

**The Kennedy Valve Mfg. Co.**
**Elmira • New York**



**KENNEDY valves . . . pipe fittings . . . fire hydrants**

# MANHATTAN STRENGTH MEMBER Construction in

# Condor HOMO-FLEX HOSE

## Has these 10 ADVANTAGES

- Extreme flexibility - easy to handle
  - Resists kinking
  - Light in weight
- Practically inseparable cover and plies—balanced homogeneous construction
- Withstands high pressures and surges with wide margin of safety
  - Uniform inside diameter
- Less elongation and expansion
  - Less fatigue to operator
  - More production
  - Lower ultimate cost

An outstanding Manhattan development in hose construction makes Hon Flex a lighter, more flexible, longer lasting hose in every service for whicl is styled. The coiled length illustrated shows how easily Homo-Flex w take the turns and twists, as workers whip it around. Homo-Flex hose d not writhe or coil under pressure. Delivers unusually long service, even u der the destructive effect of rapid pulsations of pressure due to Manhatta development of Homo-Flex Strength Member design and constructi Flexlastics throughout—plus Turnate Vulcanization—insures longer sistance to natural wear.

Men prefer Homo-Flex because it's a quicker, easier-handling, ener saving hose—"de-bulked," yet strengthened and streamlined for mod methods.

**Homo-Flex Hose styles for**

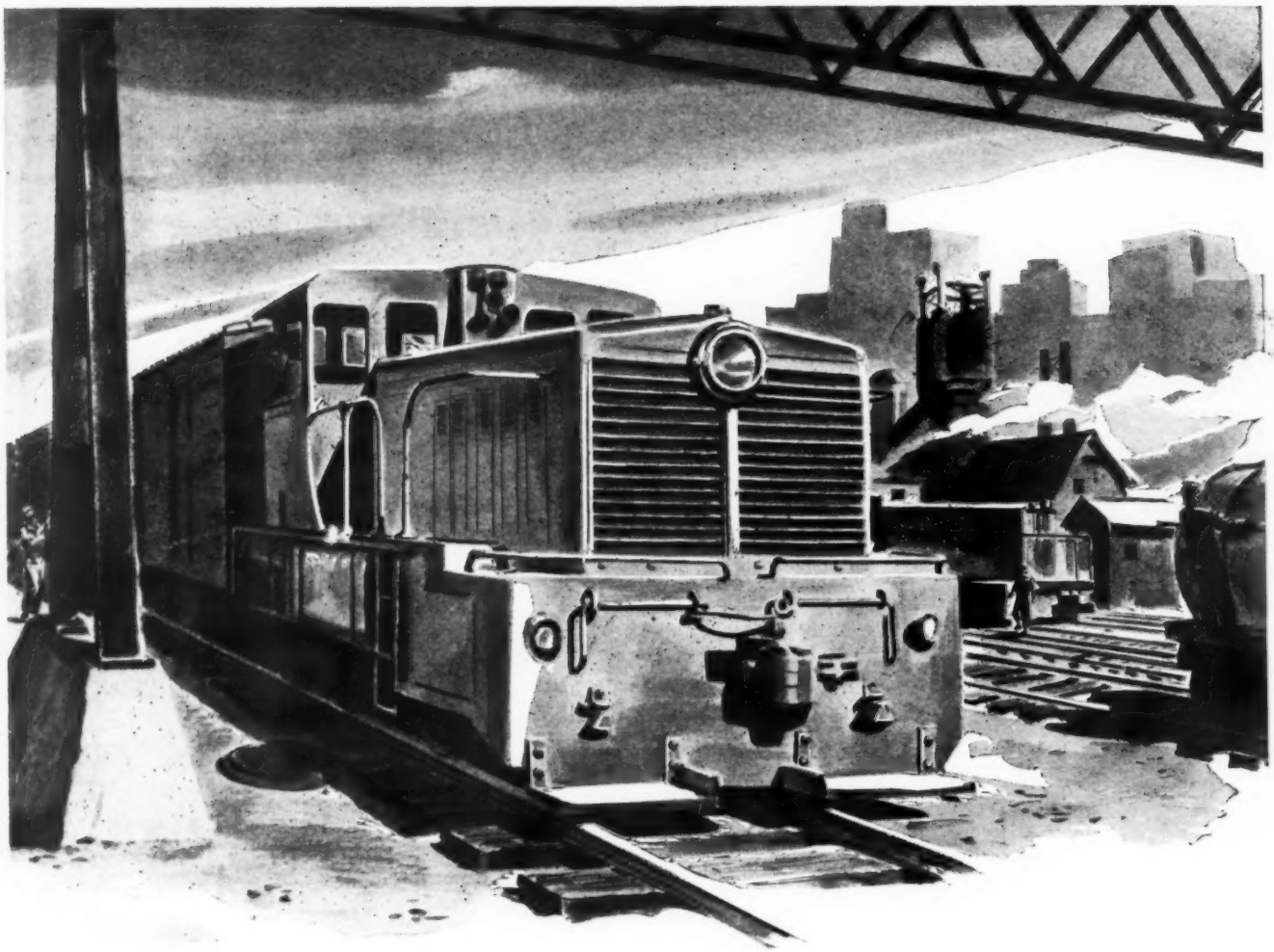
| | | | |
|---|---|---|---|
| Air, Air-Oil, Water, Steam Pressing Iron, | Orchard Spray, Oil Spray, | High Pressure Mine Spray, | Butane Propane for Tar Truck Deliveries |

The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN may make FLEXLASTICS.

# RAYBESTOS-MANHATTAN, INC.

## MANHATTAN RUBBER DIVISION

EXECUTIVE OFFICES AND FACTORIES — PASSAIC, NEW JERSEY



# She Got the Job through PULL

YES, this little lady, a Cooper-Bessemer Diesel-powered switcher, got her job through pull — the kind of pull that makes fast work of shunting heavy freight cars by the score.

Cooper-Bessemer Diesels have just the pull it takes, and have been demonstrating that fact for years in switchers and other locomotives, big and little. They combine all the features that helped prove Diesels a natural for railroad service: clean power . . . incredible stamina . . . low maintenance . . . unequaled thermal efficiency . . . space economy . . . smooth starting . . . rapid acceleration . . . sensitive control.

These qualities didn't appear just by chance in all the Cooper-Bessemer Diesel engines. They are carefully built into each unit and are a result of continuous research and development in the engineering laboratories. You will find them important factors in completely satisfying your power needs — whether it be for driving locomotives, for electric generating service, for giant earth-moving machinery and big cranes, or for any kind of industrial application where heavy-duty prime movers are required.

No matter whether your Diesel assignment is tough or easy, mobile or stationary, you want the greatest output, the utmost reliability your money can buy. So check your needs with Cooper-Bessemer.

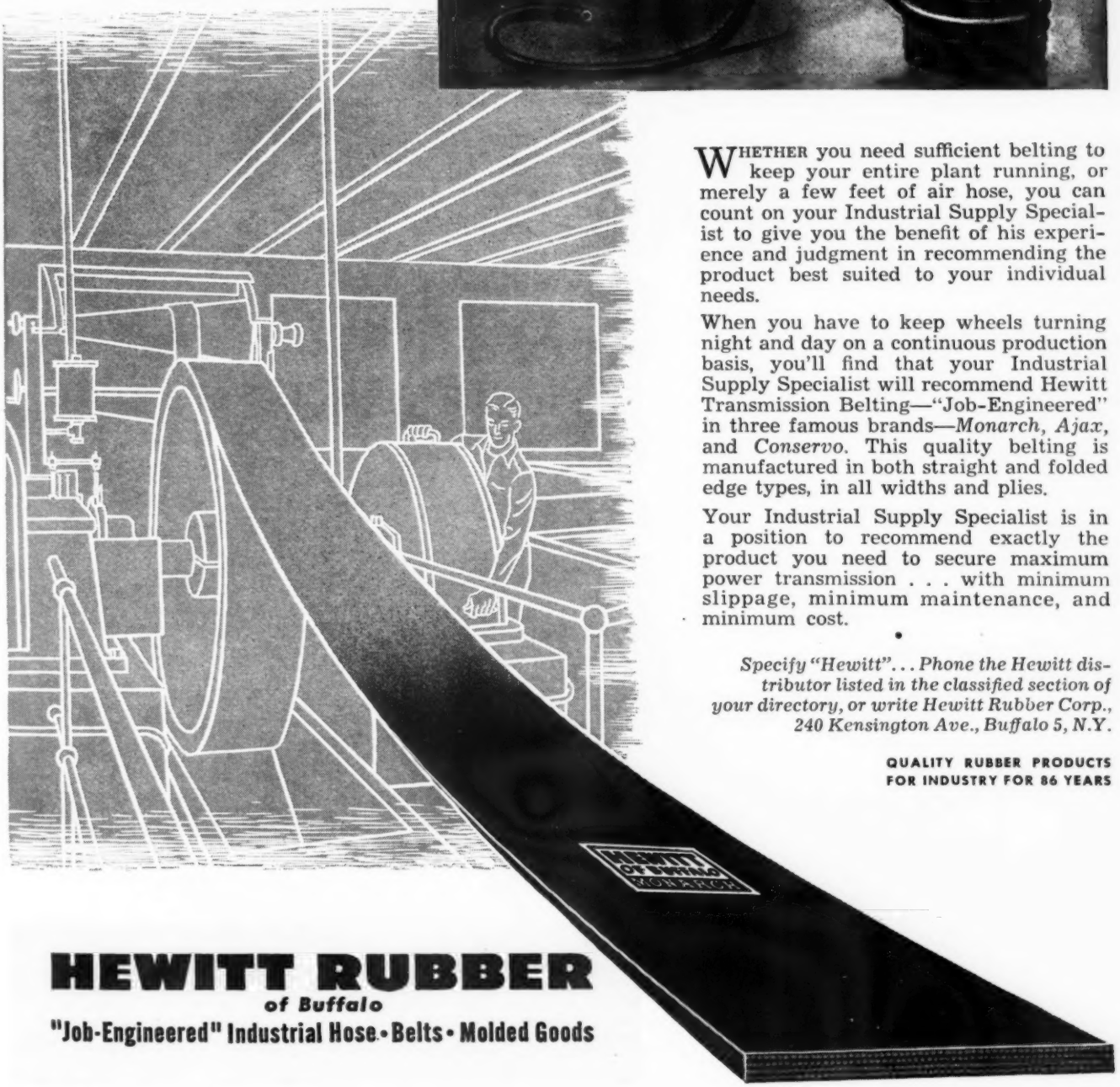
New York Washington Tulsa Dallas St. Louis Houston Los Angeles Seattle Shreveport

BUILDERS OF DEPENDABLE ENGINES FOR 113 YEARS

# Mammoth or Midget

## Whatever Your Need

**YOU CAN COUNT ON YOUR INDUSTRIAL SUPPLY SPECIALIST**




WHETHER you need sufficient belting to keep your entire plant running, or merely a few feet of air hose, you can count on your Industrial Supply Specialist to give you the benefit of his experience and judgment in recommending the product best suited to your individual needs.

When you have to keep wheels turning night and day on a continuous production basis, you'll find that your Industrial Supply Specialist will recommend Hewitt Transmission Belting—"Job-Engineered" in three famous brands—*Monarch*, *Ajax*, and *Conservo*. This quality belting is manufactured in both straight and folded edge types, in all widths and plies.

Your Industrial Supply Specialist is in a position to recommend exactly the product you need to secure maximum power transmission . . . with minimum slippage, minimum maintenance, and minimum cost.

•

*Specify "Hewitt"... Phone the Hewitt distributor listed in the classified section of your directory, or write Hewitt Rubber Corp., 240 Kensington Ave., Buffalo 5, N.Y.*

**QUALITY RUBBER PRODUCTS FOR INDUSTRY FOR 86 YEARS**

# HEWITT RUBBER

***of Buffalo***

**"Job-Engineered" Industrial Hose • Belts • Molded Goods**

# COPPER ALLOY BULLETIN

**MARINE AND POWER EDITION**

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

*Prepared by Bridgeport Brass Company* "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*


## Power Plant Operating Data Helps Increase Condenser Tube Life

### *Valuable Aid in Selecting Longer Lasting Alloys*

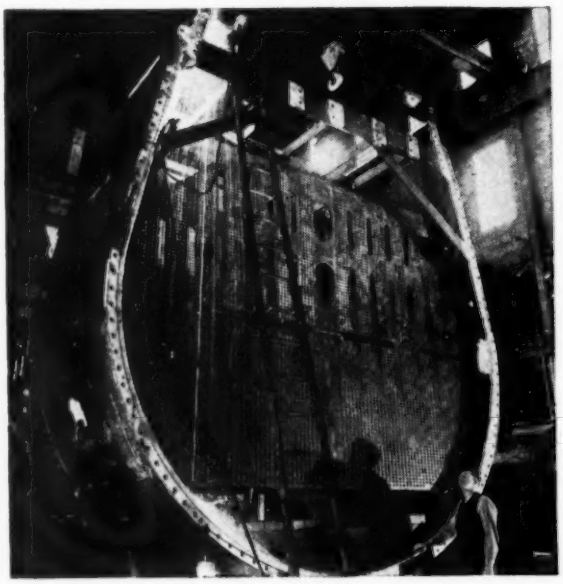
Use of the condenser tube alloy most suitable for the conditions involved is one of the important factors in obtaining greater operating efficiency, reduced maintenance, and higher condenser vacuum. The nature of the cooling water, power plant operating conditions and the severity of operating schedule all involve factors which have an important bearing on the selection of condenser tubing. Provision must also be made for additional future capacity and for the possibility of conditions becoming more severe.

Many years ago selection of tubing was hampered by the limited number of condenser tube alloys available and by the fact that there was much less information on corrosion and condenser tube performance than is now available. Fortunately the picture has changed and condenser tube manufacturers, using powerful extrusion presses and tube reducing equipment, are able to produce a wide variety of condenser tube alloys capable of longer service life under more severe conditions. Metallurgical progress and corrosion research have played an important part in this, and Bridgeport Brass Company has maintained a particularly active corrosion program consisting not only of laboratory work and field tests, but also of actual service tests carried out in collaboration with power plant engineers. We have supplied many samples of tubing to be inserted in condensers or heat exchanger units for test purposes. These are removed from time to time and examined by the laboratory. The results are correlated with information already available and a report is submitted to the power plant and to their consultants.

#### A New York Harbor Experience

Sometimes the service life of an alloy tested will be so much greater than the material previously tried that a change is unmistakably indicated. For example, a power plant located in New York harbor had been using Admiralty, which lasted a maximum of two years. They then tried out aluminum brass without a dezincification inhibitor. These tubes also failed from dezincification within two years. In 1941 this condenser was retubed with over 6000 tubes of Bridgeport's Cuzinal (arsenical aluminum brass). This alloy was developed to withstand the action of sea water moving at a high velocity which leads to so-called impingement corrosion, or inlet end corrosion.

For the balance of 1941 this condenser operated for 4000 hours; in 1942 for 6300 hours; in 1943 for 8000 hours; in 1944 for more than 8000 hours; in 1945 for more than 8000 hours—more than 34,000 hours without let-up. It is still operating under heavy schedule, and during the entire period only 56 tubes have failed. These were plugged, and have not yet been removed from the condenser. Since this represents a failure of only eight tenths of one percent under exceptionally severe wartime operating conditions, it is evident that Cuzinal (arsenical aluminum brass) is superior for these operating conditions to Admiralty or aluminum brass containing no dezincification inhibitor.



Section of Allis-Chalmers 35000 sq. ft. welded steel surface condenser.

#### Duronze IV Also Tried

An interesting feature of this experience is the fact that at the time the condenser was retubed with Cuzinal, a test installation of Duronze IV had already been in operation in the same condenser since 1938.

Duronze IV is an arsenical aluminum bronze considered to be one of the finest condenser tube alloys made. It has exceptional resistance to corrosion under severe conditions, such as rapidly flowing fresh or salt water polluted by sewage and industrial wastes, acids, cinders and other foreign matter.

The test installation of Duronze IV was left in the condenser when it was retubed in 1941. Now, all but one of the Duronze IV tubes are still going strong after 63,400 operating hours over a period of 92 months—practically full time operation. Here the possibilities of Duronze IV are again emphasized for increasing condenser tube life under difficult service conditions.

#### Data From Power Plants Important

When more operating information is available the power plant engineer is in a better position to know which type of condenser tubing will give him the longest service life. Some engineers are keeping careful records regarding the factors listed below, which represent the type of information most helpful to him.

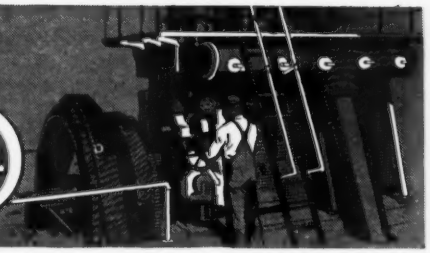
1. Water composition.
2. Steam composition.
3. Velocity of water.
4. Velocity of steam.
5. Operating procedures.
   a. Temperature of water and steam.
   b. Pressures—vacuum.
   c. Service hours.
   d. Amount of debris collected in water boxes.
   e. Frequency of cleaning.
   f. Frequency and dosage of chlorination.
   g. Frequency of tube cleaning.

#### Many Bridgeport Alloys Available

There are a number of Bridgeport condenser tube alloys giving good account of themselves in power plants all over the country and on board ships sailing the seven seas. They are not only used for condensers, but for many heat exchanger applications. Our Technical Service Department, composed of laboratory trained men, is set up to help engineers solve their corrosion problems, and arrange for test lots of tubing to be installed. Contact the nearest Bridgeport office. Also write for your copy of Bridgeport's 112-page Condenser Tube Manual, which contains practical, up-to-date information about corrosion research, condenser tube alloys, methods of installing and suggestions for increasing tube life.

# STANDARD ENGINEERS NOTEBOOK

CALOL RPM

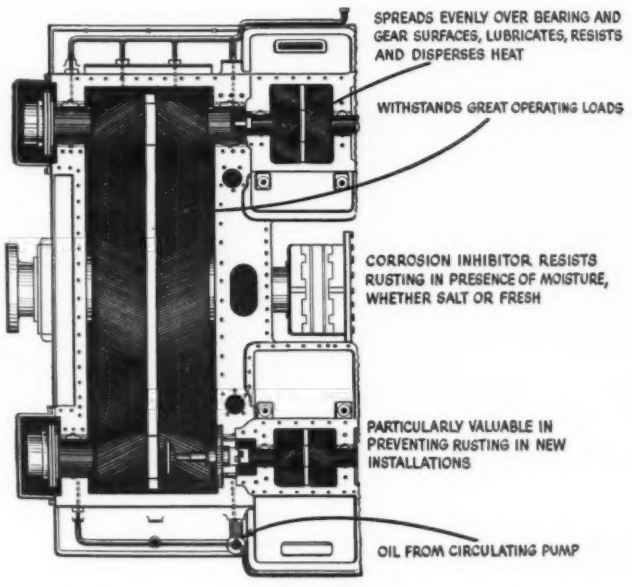


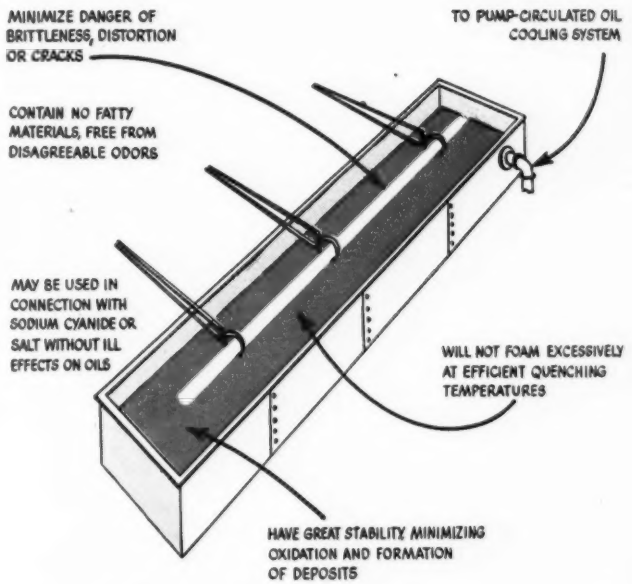
## Inhibited turbine oils prevent rust damage

The usual danger of rusting when new installations of double reduction steam turbines are first charged can be eliminated by using Calol OC Turbine Oil 19. It will also give turbine and gears full protection throughout their lives.

Calol OC Turbine Oil 19 is a compounded oil, made from selected crudes. It contains a highly effective rust inhibitor which protects against both fresh and salt water. In official tests, steel strips immersed in mixtures of Calol OC Turbine Oil 19, fresh water and synthetic sea water showed no sign of rusting after 48 hours. Calol OC Turbine Oil 19 also contains an efficient oxidation inhibitor.

The high film strength of Calol OC Turbine Oil 19 provides a wear-reducing cushion that carries the heavy weight imposed on turbine bearings. Minimum wear prevents rotor misalignment trouble. Calol OC Turbine Oil 19 is non-corrosive and separates rapidly from water with little sludge formation.


SPREADS EVENLY OVER BEARING AND GEAR SURFACES, LUBRICATES, RESISTS AND DISPERSES HEAT
WITHSTANDS GREAT OPERATING LOADS
CORROSION INHIBITOR RESISTS RUSTING IN PRESENCE OF MOISTURE, WHETHER SALT OR FRESH
PARTICULARLY VALUABLE IN PREVENTING RUSTING IN NEW INSTALLATIONS
OIL FROM CIRCULATING PUMP


MINIMIZE DANGER OF BRITTLENESS, DISTORTION OR CRACKS
TO PUMP-CIRCULATED OIL COOLING SYSTEM
CONTAIN NO FATTY MATERIALS, FREE FROM DISAGREEABLE ODORS
MAY BE USED IN CONNECTION WITH SODIUM CYANIDE OR SALT WITHOUT ILL EFFECTS ON OILS
WILL NOT FOAM EXCESSIVELY AT EFFICIENT QUENCHING TEMPERATURES
HAVE GREAT STABILITY MINIMIZING OXIDATION AND FORMATION OF DEPOSITS

## Stable oils produce uniform hardness in steel

Because they retain their original viscosities in continued use, Calol Quenching Oils maintain a constant quenching speed and produce uniform hardness in steels. They have a high resistance to oxidation and contain no fatty oils to produce disagreeable vapors.

Calol Alloy Quenching Oil consistently and quickly produces higher hardness in alloy steels. Its unusual cooling power is based on what is believed a new principle. Unlike water, it eliminates the chance of brittleness, distortion or cracks.

Calol Quenching Oil is recommended for high-carbon steels. Made from selected mineral oils covering a wide boiling range, it provides the moderate cooling-rate desirable for these steels.

For suggestions on the use of Calol Quenching Oils, information about machining various metals and the lubricants required, write for the free booklet: "Calol Cutting Fluids."

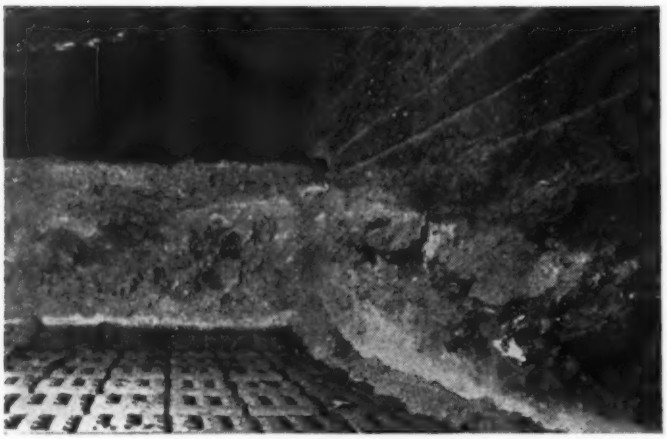
For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif., or The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

# *BEFORE* and *AFTER* with CRYSTOLON BRICK

## *The Special Refractory Brick that Guarantee:*

### MORE YEARS OF SERVICE - LESS "DOWNTIME" - LOWER UPKEEP

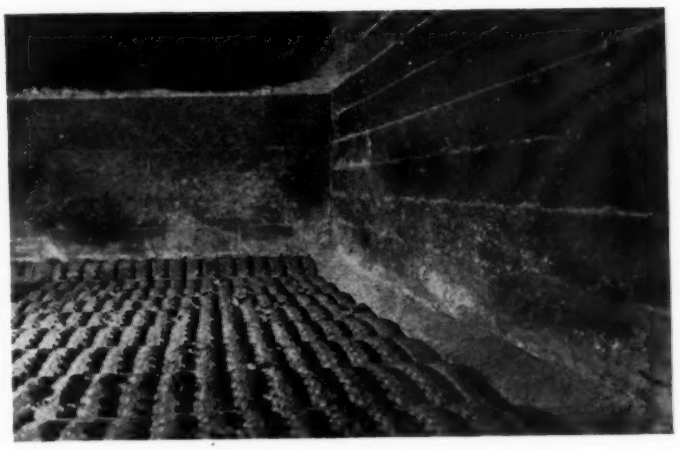


**BEFORE**

In an educational institution one of a pair of boilers had a fire brick lining (left) and after five years' service the brick have spalled and their surface has been corroded badly by penetration of coal ash slag.

**AFTER**

A CRYSTOLON Brick lining was installed in the other boiler (right) and after 12 years of service these brick are still in excellent condition, their dense surface has resisted slag penetration, they are good for many more years.



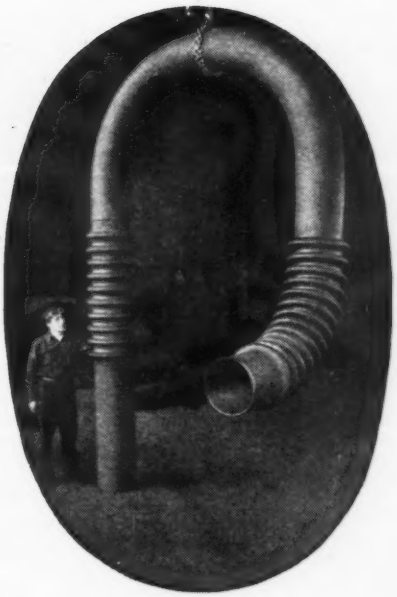
CRYSTOLON Brick are densely made of silicon carbide plus a minimum of highly refractory bond. The chemical and physical properties of these brick combine to provide four outstanding features:

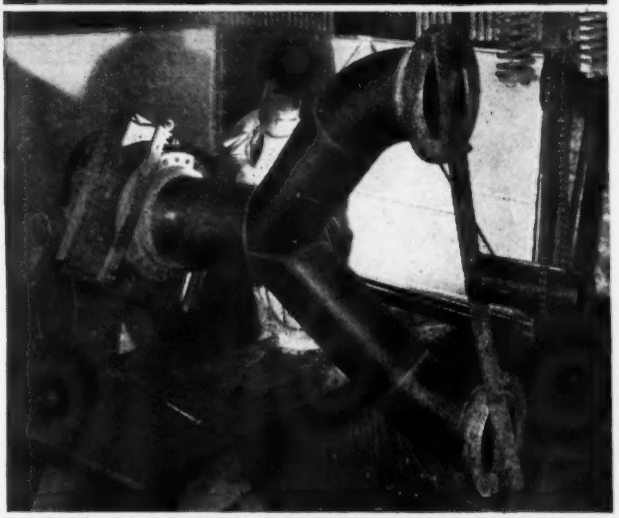
(1) *resistance to slag action,*
(2) *resistance to clinker adhesion,*
(3) *resistance to high temperatures,*
(4) *resistance to abrasion.*

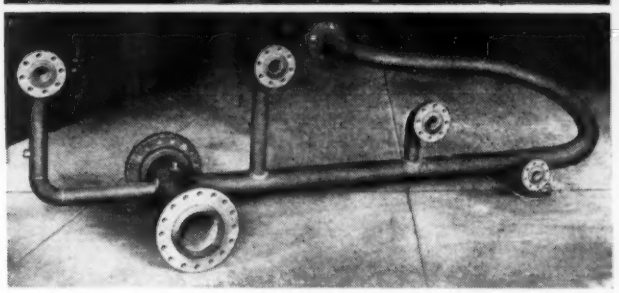
The result is that CRYSTOLON Brick give long, economical service with a minimum of maintenance expense and shut-down time.

**NORTON COMPANY — Worcester 6, Mass.**

**Norton Longer Lasting Refractories**







**MODERN**

# *Shop Fabrication*

**OF PIPING**

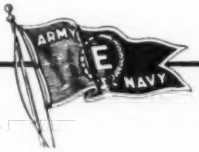
**MEANS LOWER c. p. y.**

SHOP fabrication means work done under carefully controlled conditions, with facilities for careful and correct handling of large and awkward parts; it means facilities for every necessary test while the work is still in process; it means specialized craftsmanship, trained for the specific job being done.

Is it any wonder that users of complicated piping assemblies are depending more and more on Pittsburgh Piping and Equipment Company's facilities for bending, welding, flanging, Van Stoning, machining, heat treating, stress relieving, pressure testing and gamma ray inspection?

They generally find that the job installed costs less if sub-assemblies as large as transportation facilities permit are shop fabricated. They always find that the c.p.y. (cost per year) is materially less because of the scientific engineering, modern laboratory control and expert shop craftsmanship which have produced equipment that can take ordinary wear and extraordinary punishment.

BUY MORE WAR BONDS

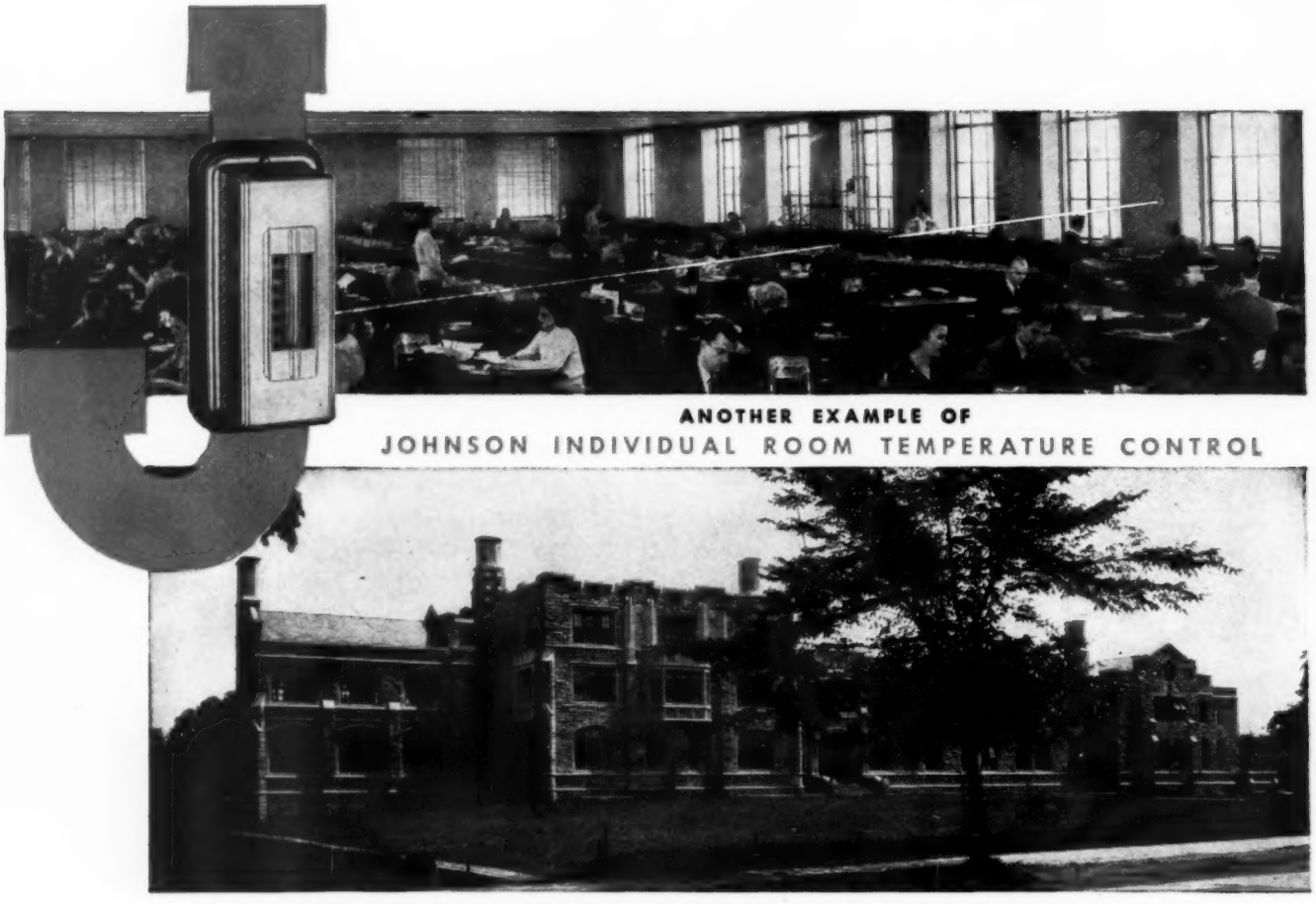



**Pittsburgh Piping**

**AND EQUIPMENT COMPANY**

**10 Forty-Third Street—Pittsburgh, Penna.**

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
634 S. Gramercy Place, Los Angeles



ANOTHER EXAMPLE OF
JOHNSON INDIVIDUAL ROOM TEMPERATURE CONTROL

Oneida Community Limited's Kenwood, N.Y., Building. A. L. Brockway, Architect, Kenwood, N.Y., E. P. Bates, Mechanical Contractor, Utica, N.Y.

## PROPER TEMPERATURE CONDITIONS ENCOURAGE EFFICIENCY OF WORKERS AND SAVE TONS OF FUEL

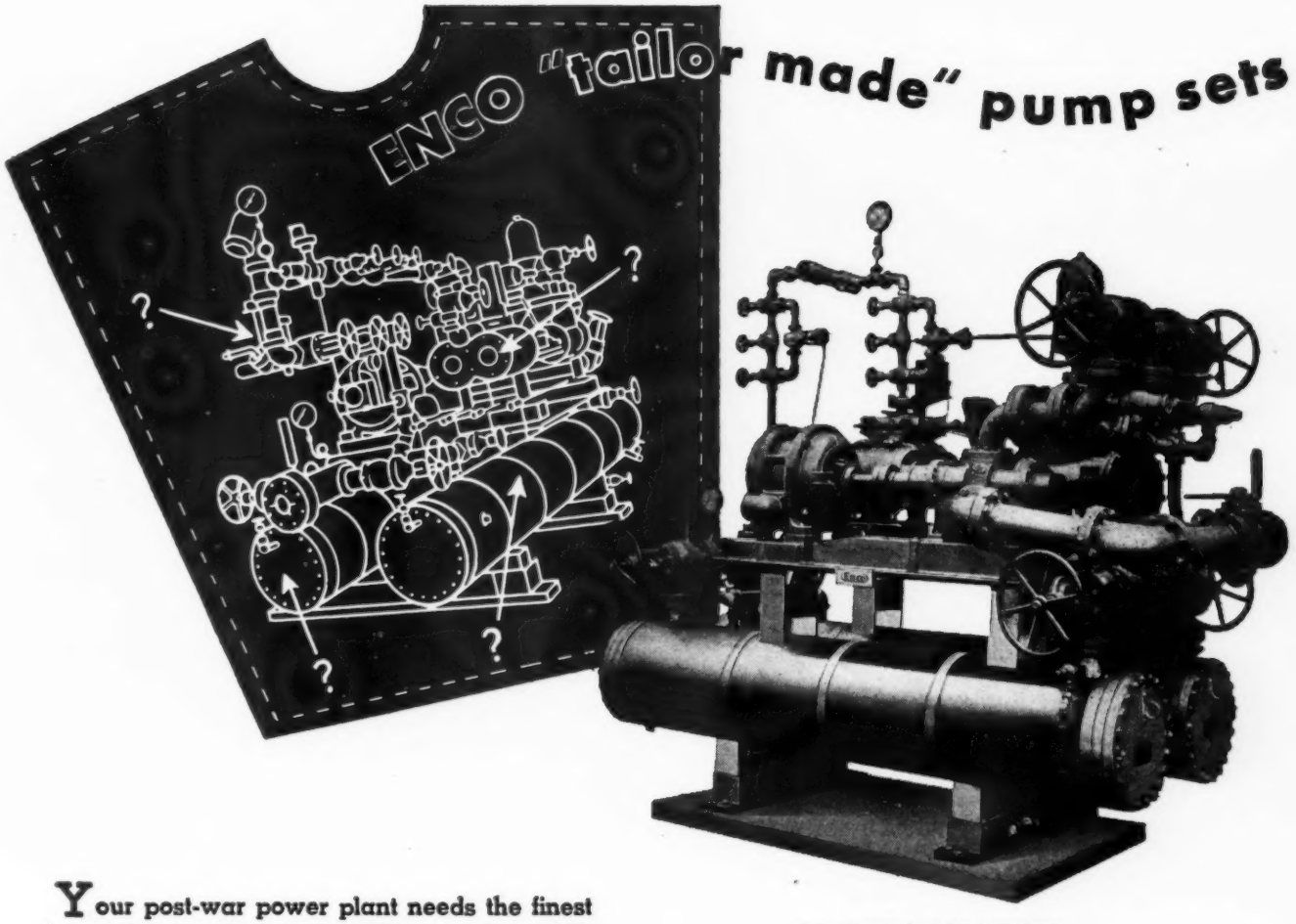
*Since 1928* . . . the men and women employed in the Oneida Community Ltd. Kenwood building have given little thought to the regulation of heat in their offices. It is AUTOMATIC. The Johnson Temperature Control System is always on the job. No shivering with cold—no overheated, lagging workers. 57 individual room thermostats operate 111 radiator valves in this Oneida Community Administration and Office building—to maintain correct temperatures, to provide healthful comfort and to save large quantities of fuel.

The uniformity of Johnson performance means that plant operators enjoy maximum convenience with minimum effort. They are able to turn their attention to other important work. Look into the advantages of Johnson Automatic Control Systems. There is a Johnson engineer near you who will be glad to talk over the desirable features and savings that the Johnson engineered Control will bring to your building . . . regardless of whether or not the building is old or new. Johnson maintains direct branch offices in principal cities. Call or write for a conference at your convenience. Johnson Service Company, Milwaukee 2, Wisconsin.

**JOHNSON** *Automatic Temperature and Air Conditioning* **CONTROL**

DESIGN · MANUFACTURE · INSTALLATION · SINCE 1885

# ENCO "tailor made" pump sets




Your post-war power plant needs the finest fuel oil pumping and heating system that money can buy. Enco's many years of engineering experience in hundreds of installations of this type enables you to obtain a completely integrated pumping and heating unit that assures dependable, low-cost pre-combustion preparation of heavy fuel oils.

**INSTALLATION COSTS ARE MINIMIZED** because the Enco oil pumping and heating unit is delivered ready to hook up and start operating. Every detail part and accessory is installed according to a coordinated design, checked and tested before it leaves our factory.

**OPERATING TROUBLES ARE ELIMINATED** because each ENCO unit embodies the latest approved engineering refinements, it is designed for years of trouble-free operation . . . all parts are easily accessible for control, maintenance or repair at a minimum of cost and trouble.

***The Enco fuel oil pumping and heating system is available in a variety of combinations of steam driven duplex or turbine pumps, and/or motor driven with rotary, centrifugal or screw pumps. Write for FREE Bulletin . . . O. B.-37 for oil burning, pumping and heating equipment.***

## 10 PLUS-FEATURES
## THAT HIGHLIGHT ENCO'S SUPERIORITY

- COMPLETELY AUTOMATIC OPERATION is assured by automatic temperature and pressure regulation valves.
- COORDINATED DESIGN SAVES SPACE, all equipment essential to the preparation of fuel oil for combustion is contained in one compact unit.
- INDIVIDUALLY DESIGNED to meet the specific needs of the particular power plant in accordance with its exact operating requirements.
- ALL PARTS VISIBLE AND ACCESSIBLE for easy operation, maintenance and repair.
- PUMPS AND HEATERS are interconnected to provide maximum flexibility of operation.
- SAFETY VALVES protect individual parts where required.
- EASIER MAINTENANCE—LESS SERVICE-TIME FOR CLEANING because straight tube, multi-pass heaters with removable heads are used.
- PUMPS OPERATE AT MODERATE SPEED, heaters designed to give the correct viscosity and velocity without fouling.
- SMOOTHER FLOW OF CLEAN FUEL TO FURNACE. Air chamber for each piston pump prevents pulsations—pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.
- CLEANER BOILER ROOM . . . all overflows connected to a common outlet, flanged drip pan catches oil drip.

EC-462

**THE ENGINEER COMPANY**
**75 West Street**
**New York 6, N. Y.**

Canadian Representative: F. J. Raskin, Ltd.
370 Rachel E., Montreal, P. Q.

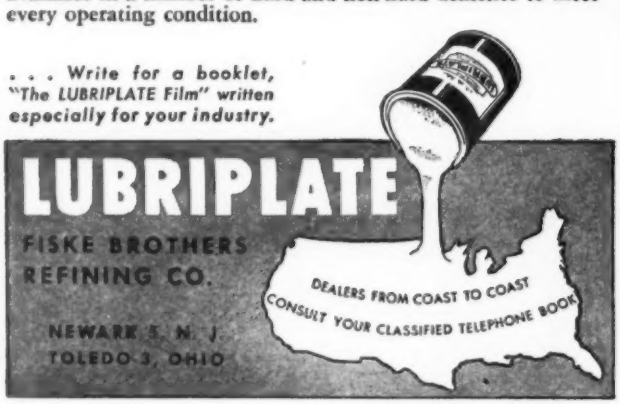
# LUBRIPLATE

## THE MODERN LUBRICANT

**THERE IS A LUBRIPLATE PRODUCT FOR YOUR EVERY NEED**

LUBRIPLATE represents one of the most important advancements in lubrication in many years. It possesses characteristics not found in conventional lubricants. In addition to superior lubricating qualities it prevents rust and corrosion. The adoption of LUBRIPLATE by practically all important industries is indeed a record of achievement. LUBRIPLATE is available in a number of fluid and non-fluid densities to meet every operating condition.

*. . . Write for a booklet, "The LUBRIPLATE Film" written especially for your industry.*




# Want More Steam in a hurry?

*Available NOW!*

**FYR-FEEDER MULTIPLE SPREADER STOKERS**

*A war-proved product*

**FEATURING:**

**AIR JET COAL PROPULSION**

**QUICK FACTS—**

- FYR-FEEDER is automatic, modern, high efficiency firing at its best!
- Increases boiler capacity with cheapest grades of coal — screenings or sweepings, wet or dry.
- Easy to operate. Responds instantly to sudden load changes. Burns fines in suspension; larger pieces on grate.
- Dependable. Multiple Burners. Quality construction.
- Easily installed in minimum time. Standard ratings from 100 to 12,000 lbs. of coal per hour. IF YOU ARE IN A HURRY WIRE, PHONE, OR WRITE.

**FYR-FEEDER** *Multiple Spreader* **STOKER**
ITS EFFICIENT
ITS AUTOMATIC
PAYS FOR ITSELF

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18-R, E. Erie St., Chicago 11, Illinois

- ☐ Interested in FYR-FEEDER Dealership
- ☐ Send literature and delivery information
- ☐ Have representative call

Name_____
Company_____
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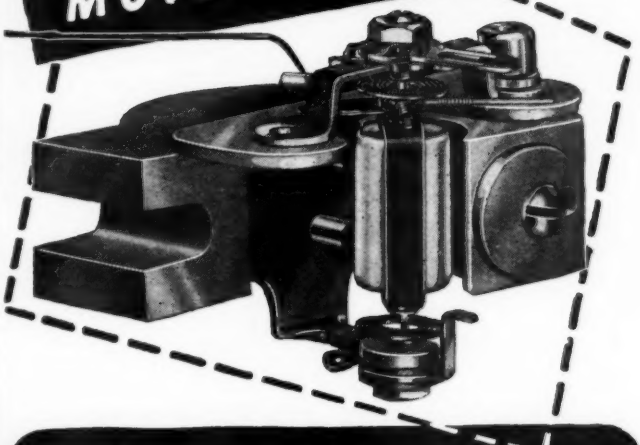
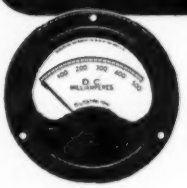
# PRECISION MOVEMENTS



# Burlington PANEL INSTRUMENTS



**The heart of every Burlington Instrument—and the reason for its high degree of dependability—is the Burlington Precision Movement.**

Design, material, and manufacturing processes are selected in such a manner that Burlington gives you a rugged instrument—which may be subjected to rough usage—and still retain its original calibration characteristics. All DC instruments employ Alnico magnets which are known to be more highly resistant to shock, heat, vibration, and stray fields than any other magnetic material.

All ranges AC & DC are available in 2½", 3½" and 4½" sizes, both square and round, flush mounting.

*Engineering Service Furnished for Specialized Applications. No Obligation. Write Today for Further Information.*

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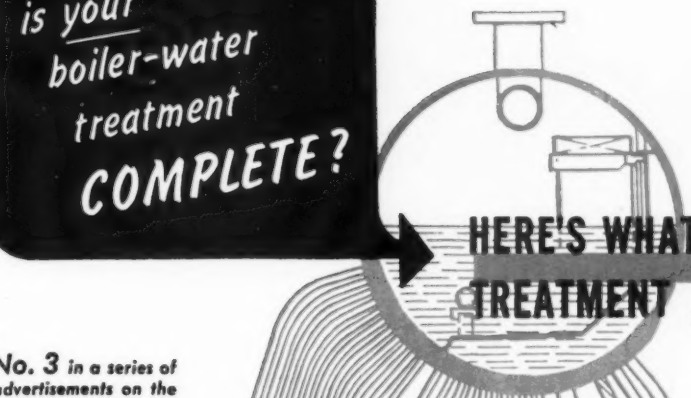
*704 FOURTH STREET* **BURLINGTON, IOWA**

PANEL INSTRUMENTS • VOLTAGE REGULATORS • AUTOMATIC SYNCHRONIZERS • FREQUENCY REGULATORS

B

*is your boiler-water treatment* **COMPLETE?**



**No. 3** *in a series of advertisements on the requirements for the COMPLETE conditioning of boiling water.*

## HERE'S WHAT *COMPLETE* TREATMENT *MUST* INCLUDE

1. **Sound Chemical Treatment**
(discussed in the February issue)

2. **A Good Organic Coagulant**

3. **Simple But Scientific Control**
(to be discussed in the April issue)

4. **Competent Service & Instruction**
(to be discussed in the May issue)

## THE PRIMARY FUNCTIONS OF A GOOD ORGANIC COAGULANT ARE:

- Maintain sludge in a "fluid" state to prevent adherence to heating surfaces.
- Eliminate carry-over by coagulation of suspended matter.
- Avoid costly blow-down through rapid settling of suspended matter and quick elimination by a short blow.

***BUT*** **— the finest coagulant is only ONE of the four requirements for COMPLETE boiler-water treatment.**

**If you want to know how a real organic coagulant works hand in hand with chemical treatment, talk it over with the DREW Man—there's no obligation!**

**AMEROID**

THE COMPLETE BOILER-WATER TREATMENT

***E. F. DREW & CO., INC.***
15 East 26th Street, New York 10, N. Y.

Representatives in key cities in the United States, Canada, Mexico, Brazil and Porto Rico

*MAIL THIS COUPON TODAY!*

E. F. Drew & Co., Inc.
15 E. 26th St., New York 10, N. Y.
I am interested in further information about COMPLETE Boiler-Water Treatment.

NAME_____

FIRM_____

ADDRESS_____

57

## Here's Money-Saving Protection For Your Compressed Air Operated Machinery and Instruments

Now, regardless of volumes required or fluctuating pressures, the new Bird-White Pur-O-fiers completely and effectively remove all moisture, oil, dirt and other foreign matter from compressed air or gas lines—preventing costly corrosion and gumming in compressed air-operated machinery and instruments.

Operating on the principle of centrifugal action, a high speed Turbo-rotor forces the tiny particles of foreign matter outward where they are trapped and drained off.

Single units can accommodate up to 100 cubic feet. Above this range multiple units are recommended.

New applications for Bird-White Pur-O-fiers are being developed every day. Write for Bulletin No. 10 giving complete information.

BIRD-WHITE COMPANY
Dept. PM 3120 West Lake St.
Chicago 12, Illinois

PATENTED

# TOUGH OVERLAYS and PATCHES for Concrete or Wood Floors

Resurface or patch broken concrete floors with tough RUGGEDWEAR resurfacer. Here's a material which will stand up under the most punishing traffic conditions. Simple to install—no chopping or chipping required. Merely sweep out the spot to be repaired—mix the material—trowel it on. Holds solid and tight right up to irregular edge of old concrete. Provides a firmer, tougher, smoother, more rugged wearing surface. Used indoors or out. Dries fast.

## MAIL COUPON for FREE TRIAL OFFER

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3677 Filbert St., Philadelphia 4, Pa.

Please send me complete RUGGEDWEAR information and details of FREE TRIAL OFFER—no obligation.

Name .....
Company .....
Address .....

# Boiler Tubes

## ANY SIZE—BENT OR STRAIGHT

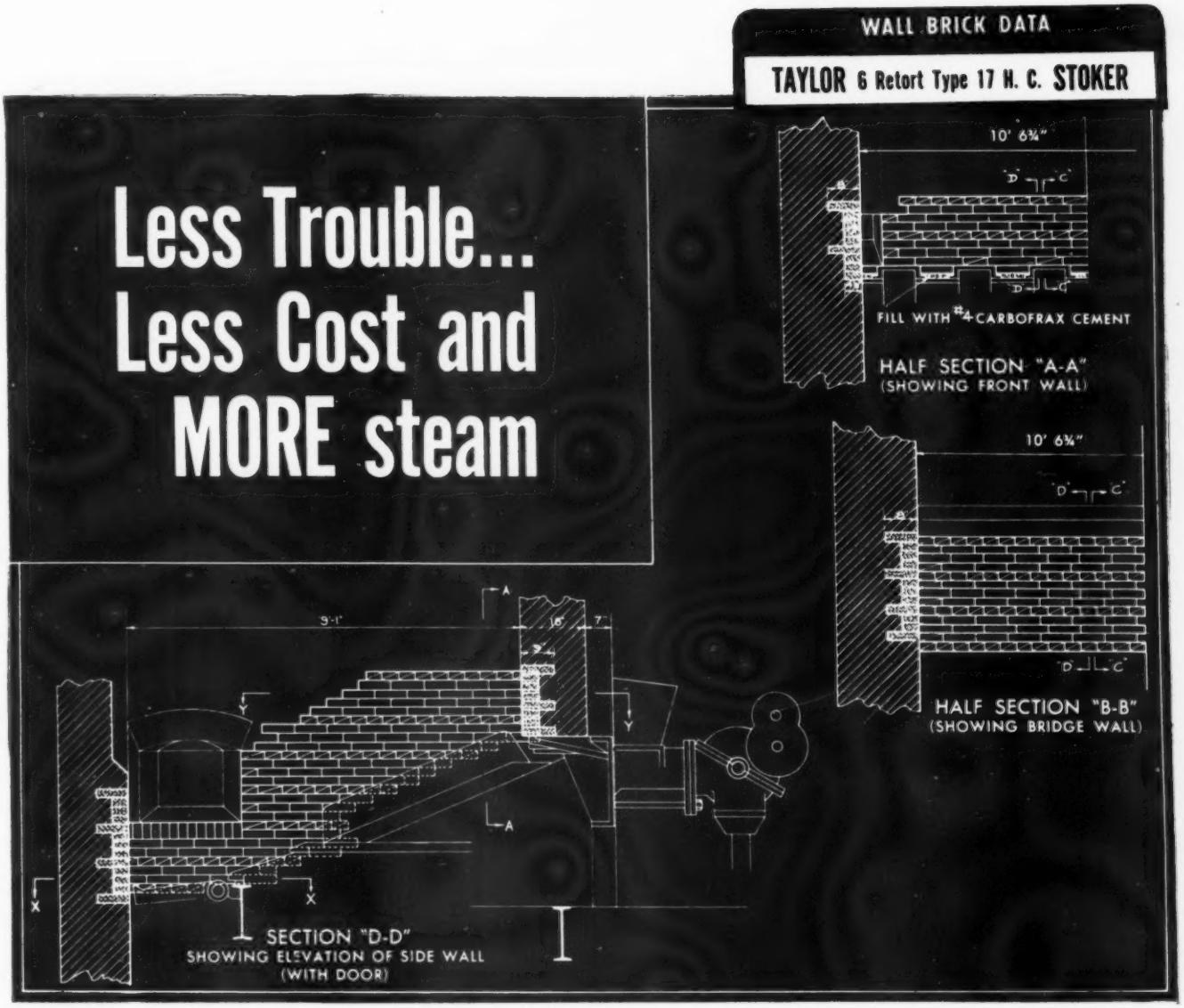
This organization has the experience and facilities to meet your most exacting requirements. We can promise quick delivery on precision work, guaranteeing accuracy as to length and bend. Why not send that next order to "Boiler Tube?"

## BOILER TUBE CO. OF AMERICA

Preble Ave. & Edgerley St., N. S.,
PITTSBURGH, PA.

PITTSBURGH • NEW YORK • CHICAGO
FRED S. RENAULD & CO., LOS ANGELES

# Less Trouble... Less Cost and MORE steam




Specifically engineered for greatest efficiency is the CARBOFRAX silicon carbide brick setting for use with a Type HC-6 Taylor Stoker. Although actual coverage is determined by operating conditions the major benefits of a CARBOFRAX lining are less trouble, less cost and *more* steam.

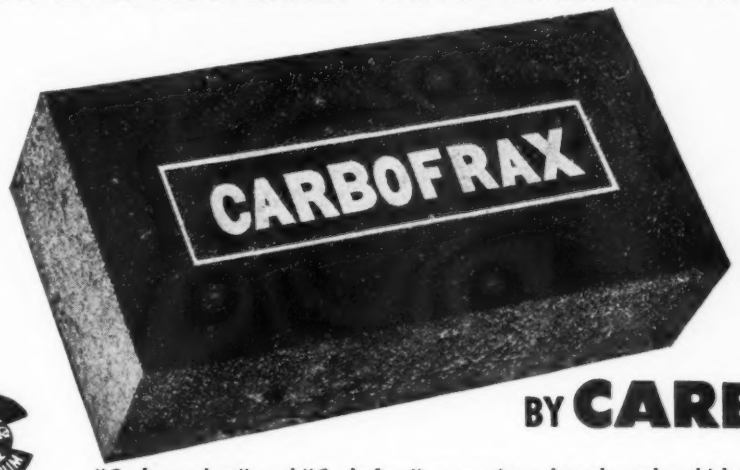
**LESS TROUBLE** is a basic advantage thanks to the fact that troublesome clinker formations cannot anchor on the surface of CARBOFRAX brick. As these brick do not soften even at extremely high temperatures the moving fuel bed tends to keep the walls clean. Any accumulations that may remain are easily barred off.

**LESS COST** is a two-fold proposition. There's a substantial saving resulting from the better fuel combustion. And the long life of CARBOFRAX linings is a strong economic point. 8 to 10 years service without replacements of these brick is not exceptional.

**MORE STEAM** results for two reasons. First, the entire grate area is utilized; and secondly, furnaces are kept in steady, continuous operation. Outages for lining repairs are rare, and on-line service is the order year in and year out.

It pays well to fully investigate the advantages of super refractory CARBOFRAX settings. Their high refractoriness, great strength, and resistance to mechanical and flame abrasion are specific benefits which lead to a better operating report.

An illustrated technical booklet entitled "CARBOFRAX in Boiler Furnaces" contains information of value to you. We'll send a copy promptly, if you'll just write to Dept. G-36, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

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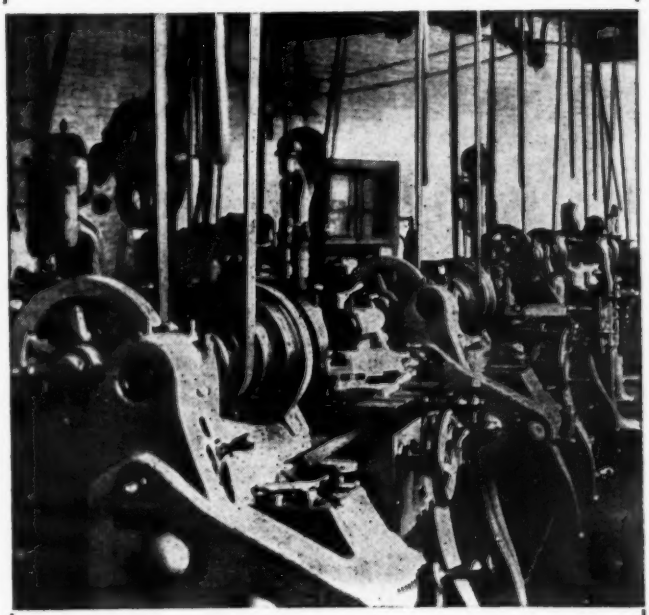

**They may need a rest. Probably some should be replaced. Certainly they deserve inspection and care. *Now* is the time to replace worn belts with TANNATE Leather Belting for maximum output on any type of drive . . . vertical, floor, wall or ceiling—with large or small motor. On any machine, a TANNATE-belted drive will *maintain consistently high production*, without slip and stretch, without stoppage or breakdowns.**

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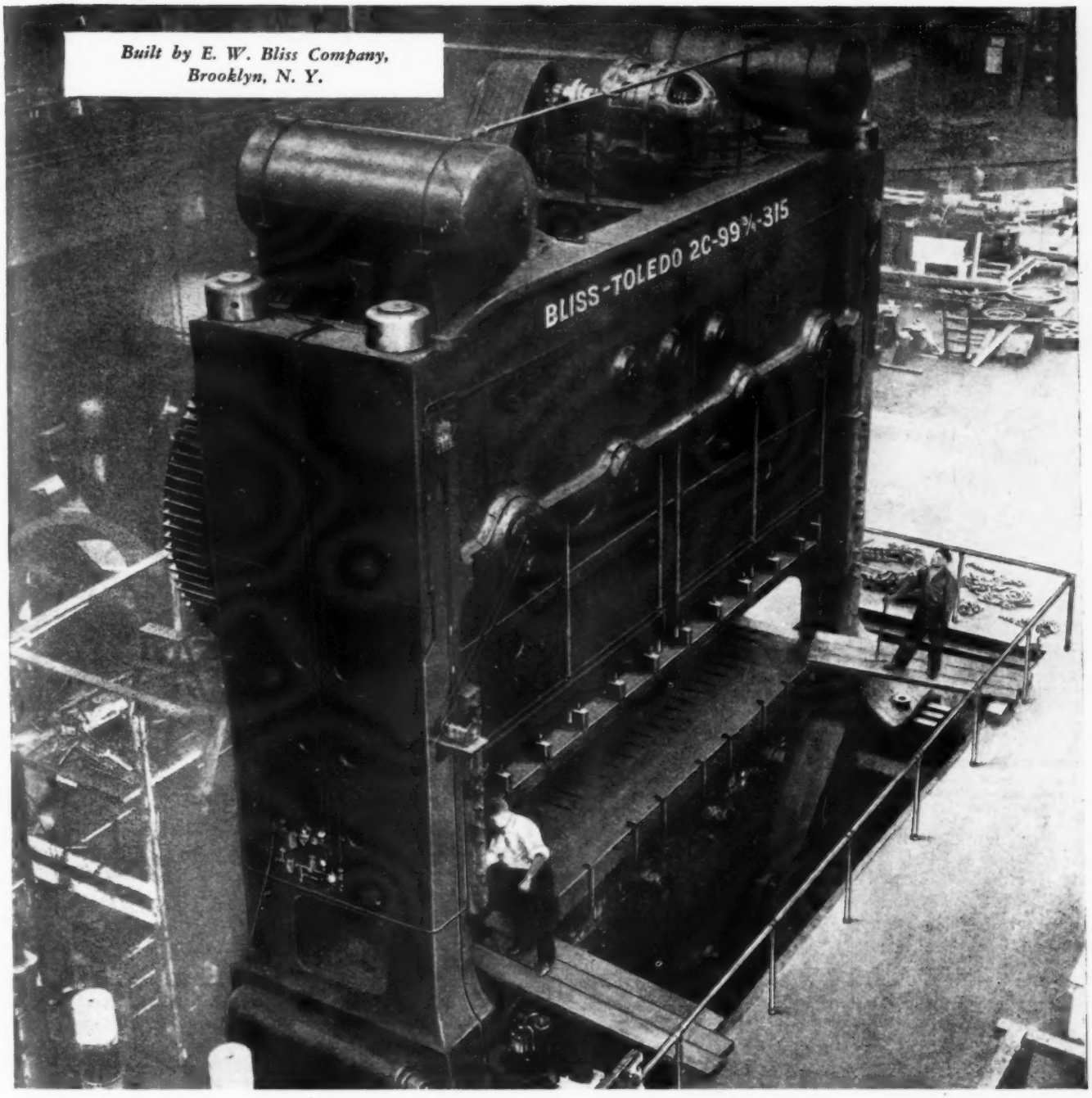


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The press was designed primarily to blank out chassis frames and produces two frames every ten seconds, operating at 6 strokes per minute.

To help make its work easier and more accurate; to increase its endurance; and decrease maintenance; Timken Tapered Roller Bearings are applied on the drive shaft and flywheel, clutch and brake, where they eliminate friction, prevent wear, carry radial, thrust and combined loads and hold shafts and gears in correct and constant alignment.

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P.S. No matter what kind of equipment you are building, it will pay you to make sure the trade-mark "TIMKEN" is stamped on every bearing you use.

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"Most economical in steam-consumption and maintenance". Design of every part, fitting, etc., based on our experience of 25 years with the successful manufacture and operation of this type of conveyors and on our full appreciation of their special requirements.
We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

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- "Efficiency 100%—requiring no hand-cleaning"
- Every tube swept clean of soot and fly-ash END TO END—no matter how irregular the tube-layout may be.
- Minimum steam or air-consumption—as operation (four successive puffs of steam or air) requires only about one minute.
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- No maintenance—as there are no moving parts in the hot boiler.
- Best investment—as frequent, thorough and convenient soot-removal is bound to result in reduced flue-gas temperatures and attendant savings in fuel.

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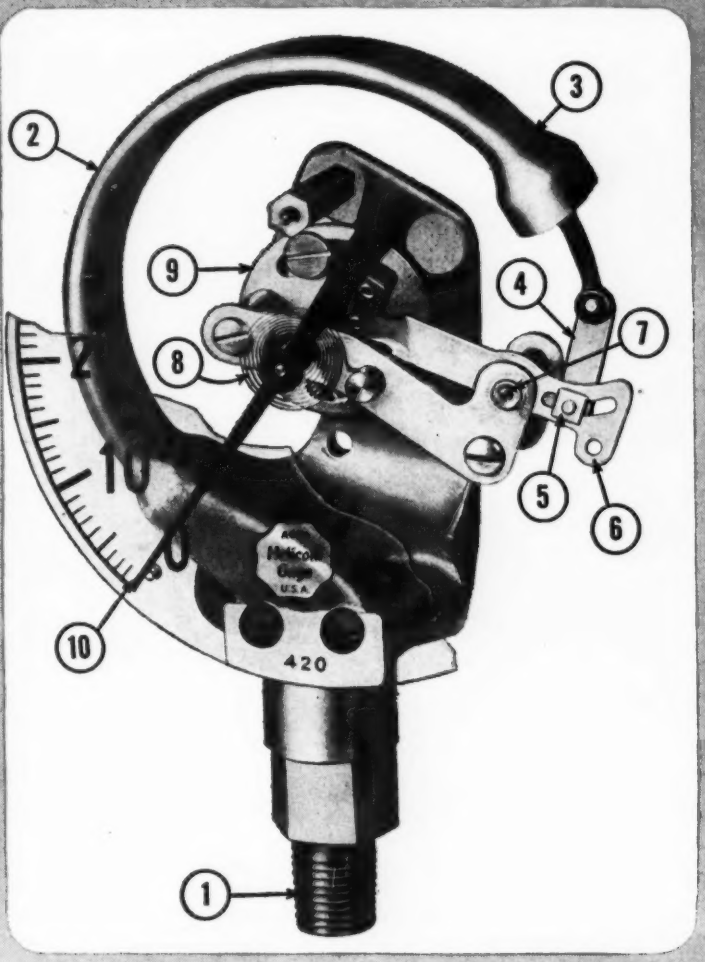
# How the Helicoid Gage Works




***PRESSURE*** enters the socket **(1)** connected to pressure source. Pressure to be measured may be air, steam, water, oil, or any liquid or gas. Thru socket, the pressure enters Bourdon tube **(2)**.

***BOURDON TUBE*** **(2)** is an oval-shaped tube of semi-circular form with a sealed end **(3)**. Any pressure in the tube, in excess of external or atmospheric pressure, causes tube to assume a more circular cross section. The flat sides are therefore forced apart, and the tube tends to straighten out at the free end, and tip **(3)** moves outward. The reverse effect occurs under vacuum, when the pressure in the tube is less than the external or atmospheric pressure. This movement of the tube at the free end is called tip travel. In principle, it's just as simple as blowing into a limp glove, causing the fingers to move as they fill with air. As the tube tends to straighten, the tip **(3)** moves outward. On vacuum (pressure below atmospheric) the tip moves inward.

***CONNECTING LINK*** **(4)** connects the tip of Bourdon tube to movement slide nut **(5)**. The tip end of the link travels in a straight line while the movement cam **(6)** travels in an arc around pivot **(7)**.

***MOVEMENT SLIDE NUT*** **(5)** which joins the connecting link **(4)** to the movement cam **(6)** is adjustable, and is used for calibrating gage. Lengthening or shortening distance of slide nut **(5)** from pivot **(7)** is necessary to get exact relationship required to translate the travel at the top to a 280° revolution of the pointer shaft. Moving the slide nut outward decreases amount of travel of pointer. Moving slide nut inward increases the pointer travel. The Helicoid movement is made with this adjustment at the rear. Hence, the Helicoid Gage can be calibrated as a unit by removing the entire system from the case, but without removing the pointer and the dial. This saves much time when calibrating.

***CAM*** **(6)**, which is toothless, in contact with the Helicoid roller of the movement, multiplies the tip travel into rotary motion of the pointer shaft. A tip travel of 3/16″ is multiplied to a scale length of 10″ on a 4½″ dial. Positive and practically frictionless motion is assured by the rolling action of the polished cam surface on the polished Helicoid roller.

***HAIRSPRING*** **(8)** holds the lower surface of the roller groove in continuous contact with lower surface of the cam facing. Both of these surfaces are polished.

***BOTTOM PLATE*** **(9)** of movement is rotatable. Rotating this movement changes the relationship between the direction of the tip travel and direction of travel of connecting link. This relationship must be such that every increment of movement of the tip is translated into uniform increments of angular rotation of the cam, and hence equal increments of travel of the pointer. The rotary feature of this movement is advantageous when calibrating the gage.

***POINTER*** **(10)** travels uniformly around dial for equal changes in pressure, if the gage is in calibration.

The gage shows the difference between pressure in the gage system and atmospheric pressure, commonly known as gage pressure in contrast to absolute pressure. Zero mark on dial represents atmospheric pressure, about 14.7 p.s.i. absolute at sea level. A vacuum gage shows the difference between atmospheric pressure and that pressure to be measured below atmospheric.


ACCO

*(This is page 3, of the new Helicoid Gage catalog. Send for a copy.)*

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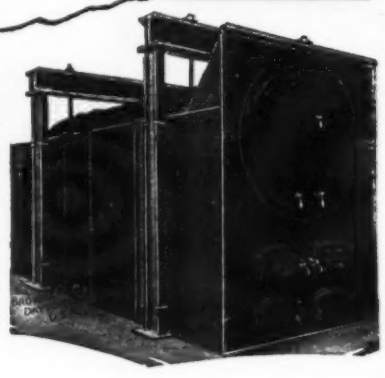

This is the type of Brownell Boiler referred to by our correspondent—a Horizontal Return Tubular Boiler.

Here are several sentences from a letter which we recently received from the president of a company that manufactures clay products:

"Many years ago—our oldest employees think at least forty years—you installed a boiler in our plant at - - - - . We find ourselves in the market for a new boiler of exactly the same type. Advise if you still manufacture that type and make us a quotation."

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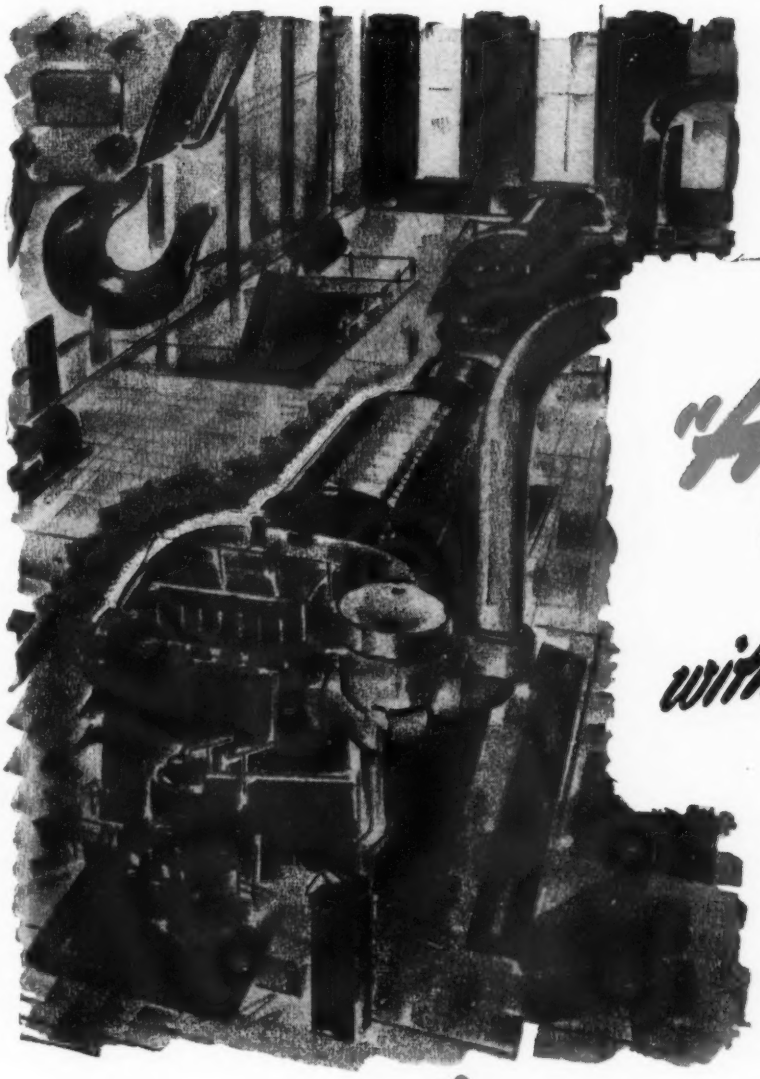

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**Oiling system clean at all times . . .**
**Low maintenance costs . . .**
**Tycol turbine oils used exclusively..."**

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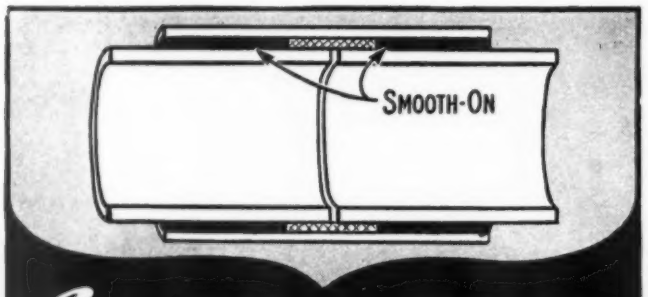


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He found, on removing the broken flanges, that the pipe could not again be gotten back into flanges. So he enclosed the open ends in a sleeve of slightly larger cast-iron pipe, packing oakum tightly around the gap in the steam pipe. The remaining space in the sleeve was then tamped full of Smooth-On No. 1 Iron Repair Cement.

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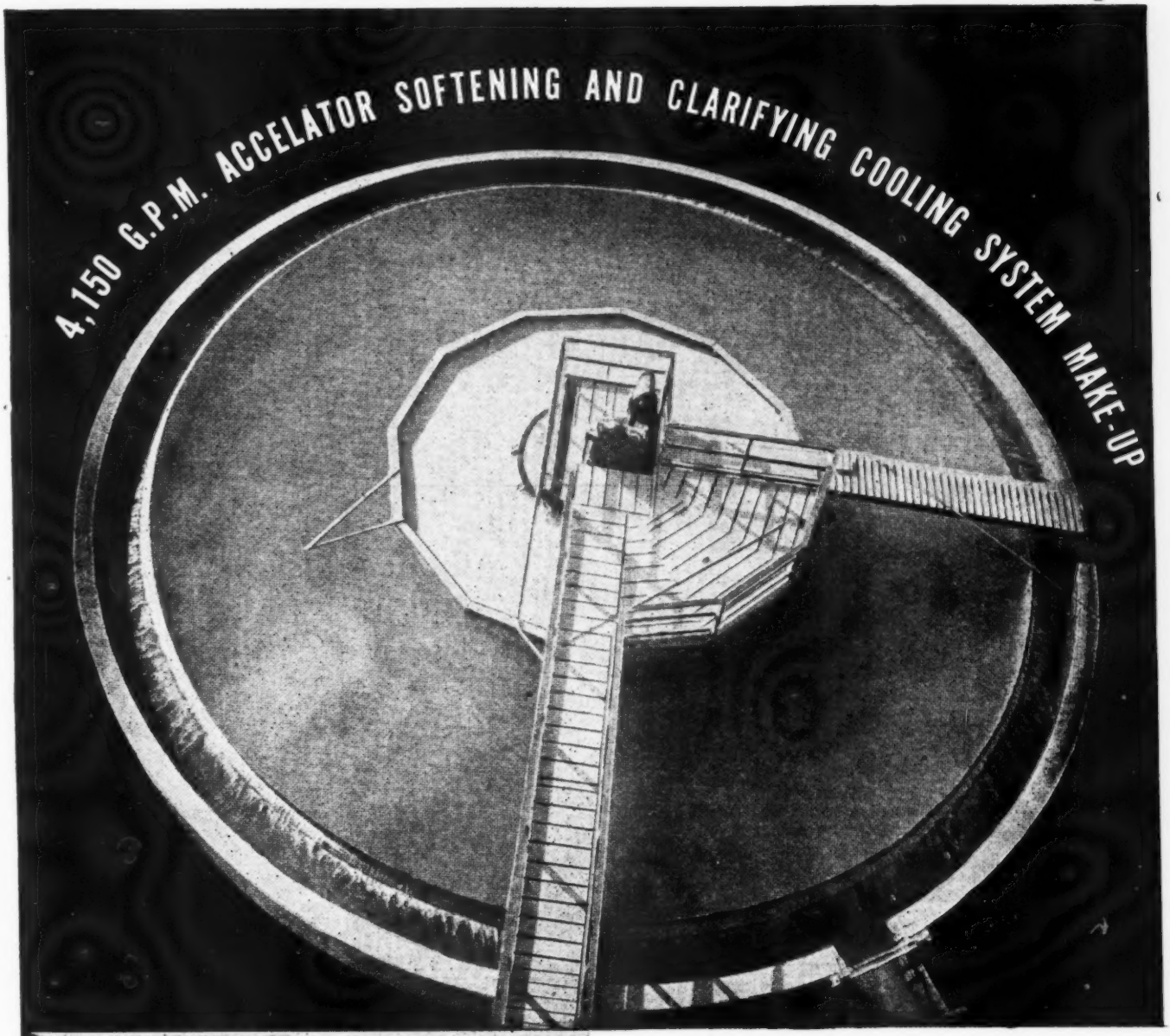


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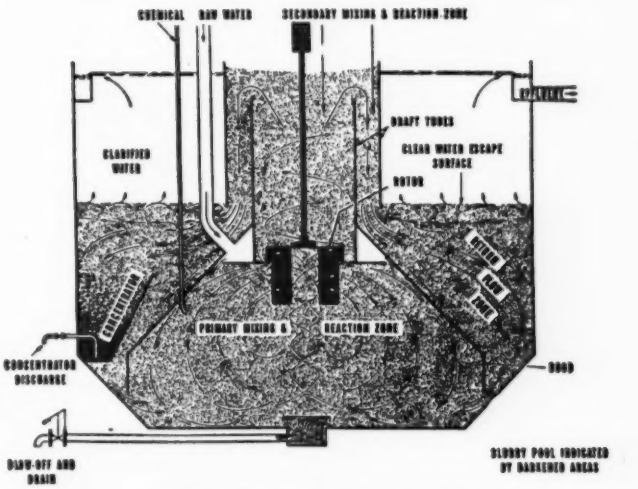


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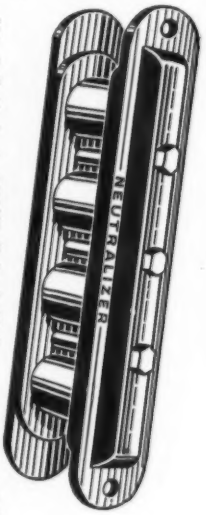


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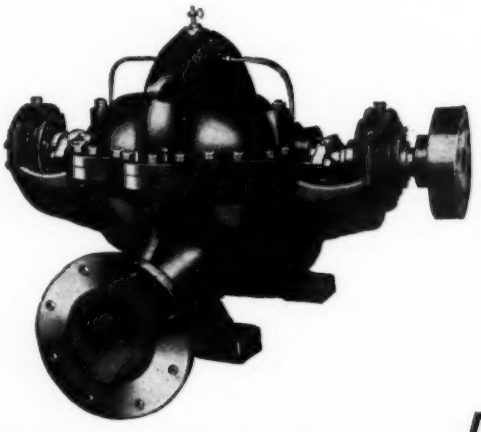

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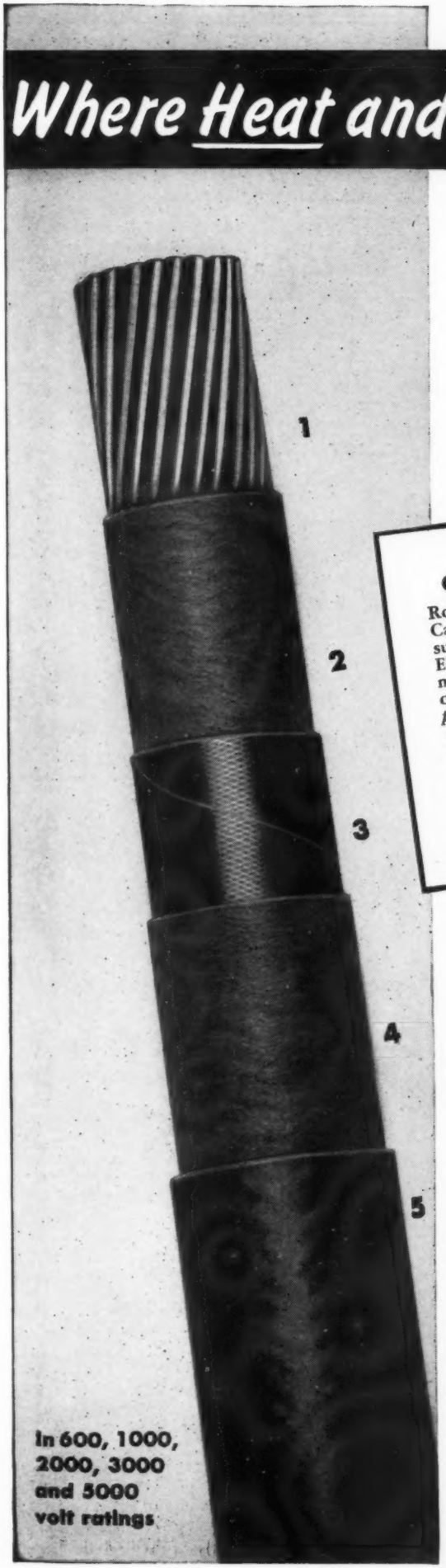


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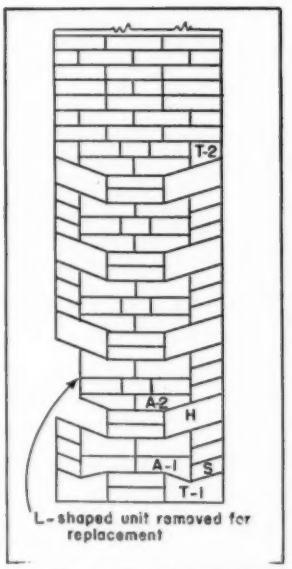


L-shaped unit removed for replacement

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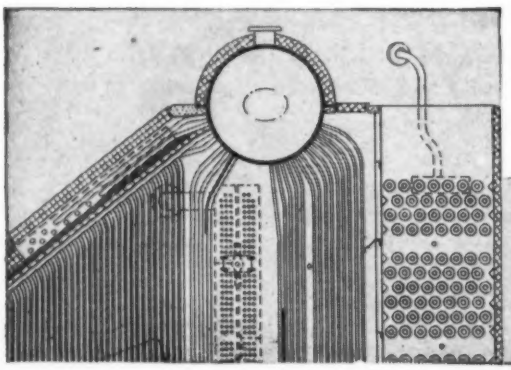
FIG. 277



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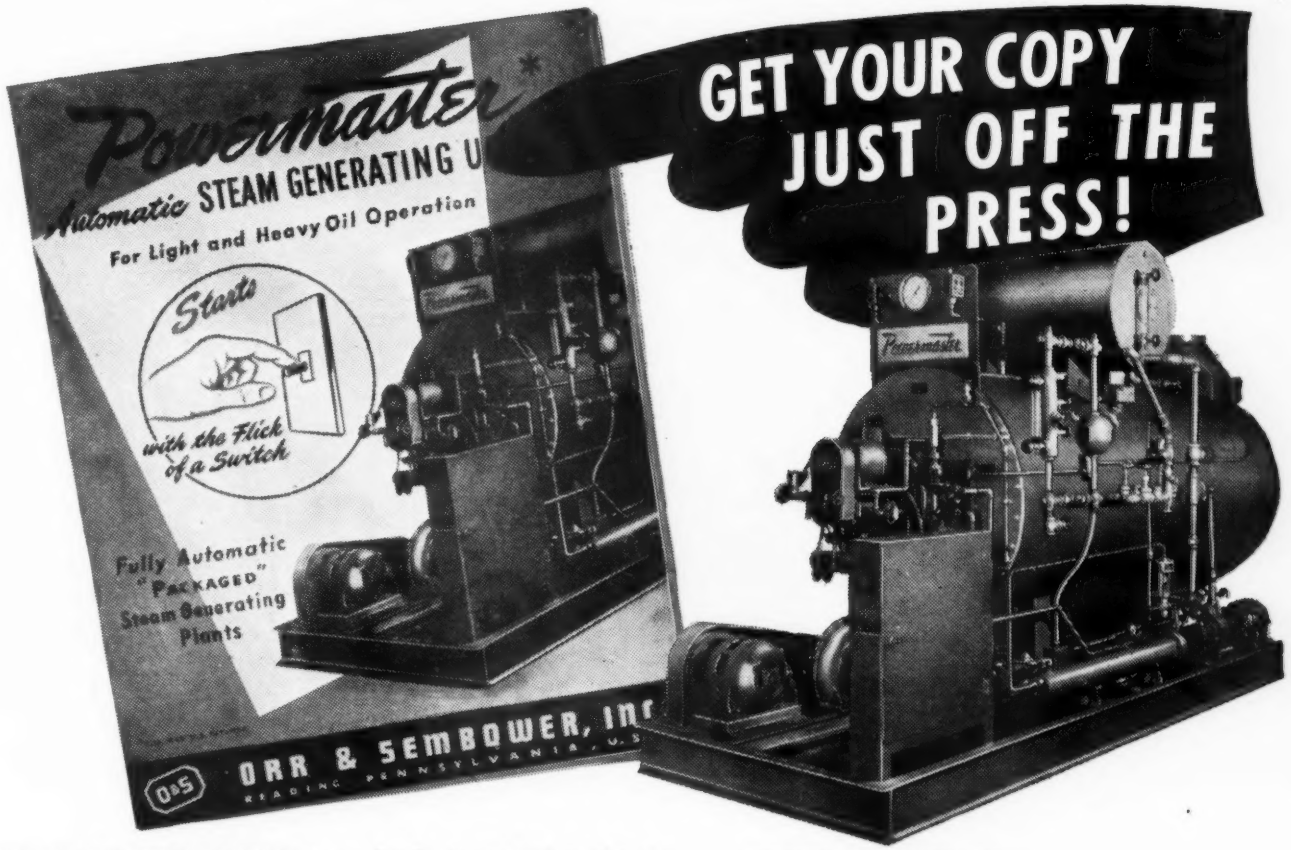
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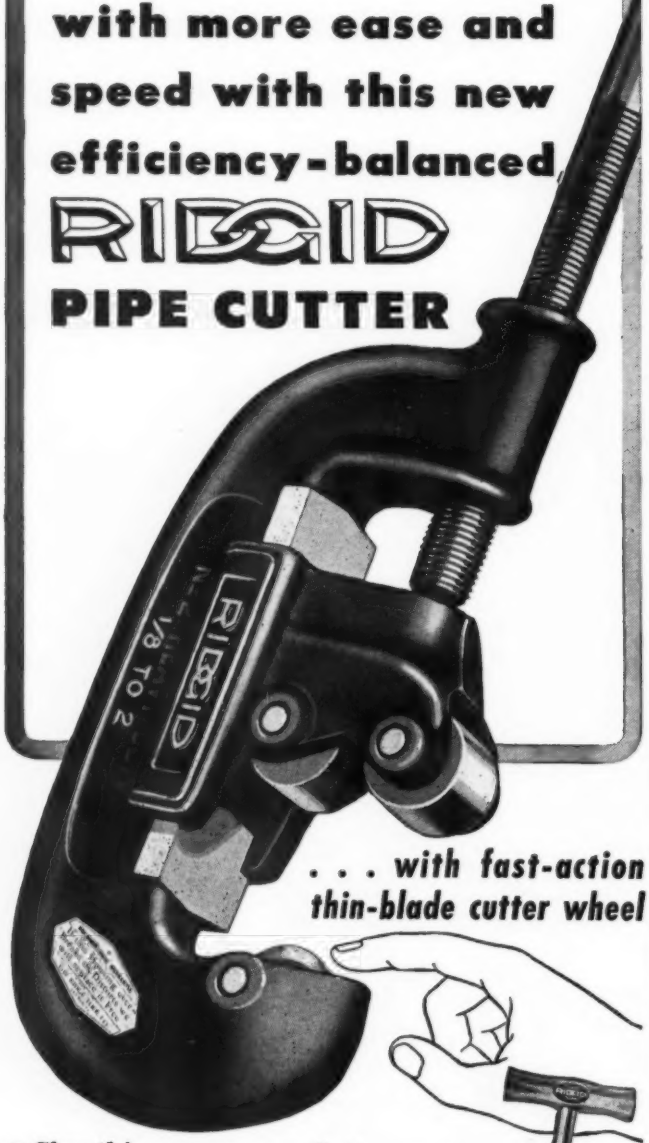


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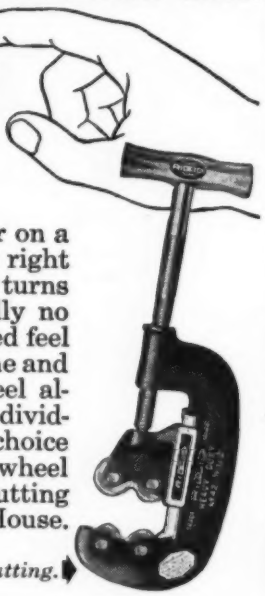

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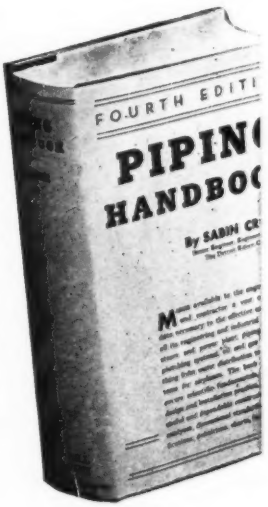


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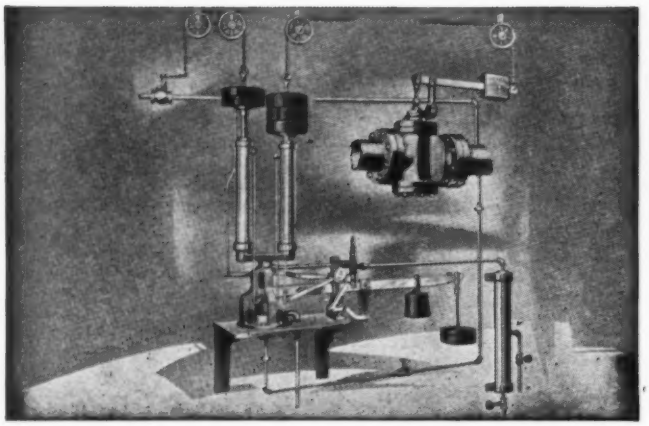

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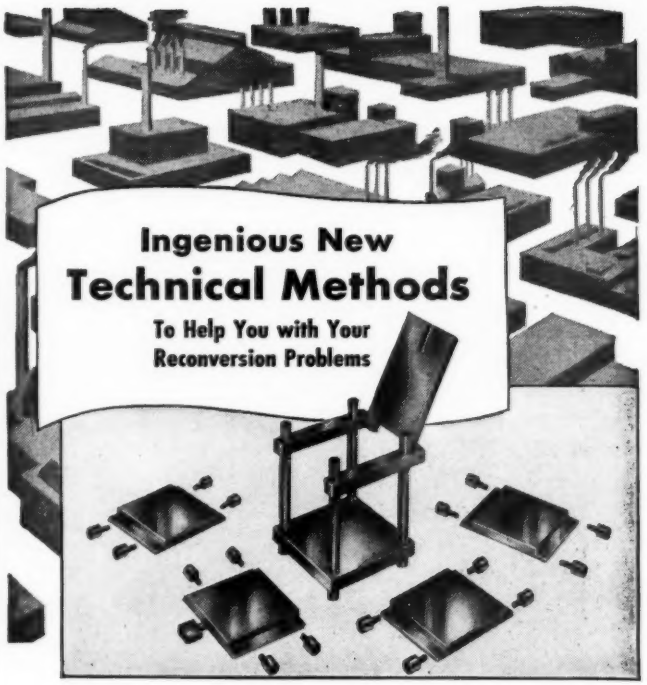


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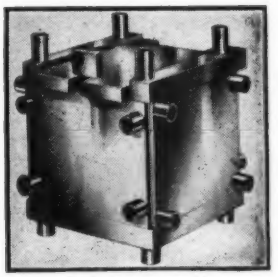

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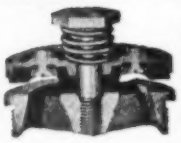

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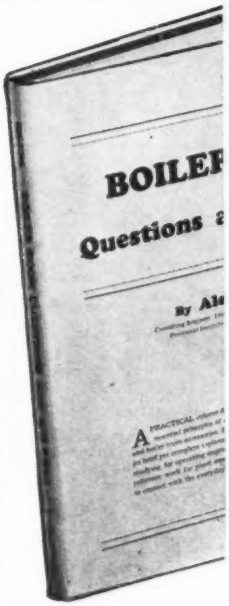


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POWER PLANT machinery inspection engineer wanted by leading boiler and machinery insurance company. Locations: Spartanburg, South Carolina and Chicago, Illinois. Technical graduates not over 35 preferred. Practical experience in the operation or maintenance of prime movers and electrical equipment necessary. Permanent position with good future possibilities. In reply, give age, employment record and salary expected. P-991, Power, 330 W. 42nd St., New York 18, N. Y.

TWO FINE Opportunities, both factory positions with manufacturer famous York-Heat, Steam-Pak products: (1) Sales Engineer familiar steam boiler applications, high and low pressure boilers and piping, industrial oil-fired equipment. Major responsibility contact and set up distributor organizations. (2) Service Engineer with sound experience steam boilers, high and low pressure boilers and piping, industrial oil burners. Major responsibility working with factory, field organizations on service problems. Salaries open on both. Industrial experience essential. Write giving complete resume experience, photograph, salary required. Or phone, wire collect. Contact George Frank, manager Industrial Division, York-Shipley, Inc., York, Penna. Phone York 6881.

POSITION OF assistant power plant superintendent open in expanding pulp and paper operation in South. Qualifications: around 35 years of age, graduate in mechanical and electrical engineering with supervisory experience in power plant. Prefer Southerner or person who has lived in South for considerable length of time. Give age, marital status, educational background, experience and other pertinent information in first letter. All inquiries will be held confidential. P-105, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: MECHANICAL and chemical engineer with experience in heat transfer work in the oil industry or other process work. Old established concern located near Chicago offers excellent opportunities because of expansion in this field. P-106, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: DRAFTSMEN and tracers from beginners up to designers by an organization of long standing in boiler and general heat transfer work for power plant and marine fields. Excellent opportunities due to expansion program. Location near Chicago. P-107, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: A Product Engineer to assume executive responsibilities for proposals, contracts and design, in cooperation with our engineering department, of bent watertube boilers —air-heaters, superheaters and fan application for power installations. Personnel Dept., Wm. Bros Boiler & Mfg. Co., Minneapolis, Minnesota.

WANTED. A Proposal Engineer to assume responsibility for the preparation of proposals and contracts relating to bent watertube boilers, for power installations. Personnel Dept., Wm. Bros Boiler & Mfg. Co., Minneapolis, Minnesota.

WANTED: A Field Engineer experienced in selling bent watertube boilers, for power installations. Our business is 63 years old and growing steadily. In a completely equipped modern plant we manufacture one of the most complete lines of boilers and stokers. This is a rare opportunity that warrants investigation by engineers wanting advancement and security. Give us complete personal history and salary expected in first letter. Personnel Dept., Wm. Bros Boiler & Mfg. Co., Minneapolis, Minnesota.

## EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of 36 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

## POSITIONS WANTED

POWER ENGINEER: 25 years exp. plant maint. & oper. heat balance, fuel economics. I.C.S.M.E. PW-944, Power, 330 W. 42nd St., New York 18, N. Y.

PLANT ELECTRICAL Engineer, fourteen years experience in design, construction, testing and maintenance of industrial electrical installations with leading steel and by-product coke manufacturer and shipyard. Desires similar position with progressive firm. PW-993, Power, 330 W. 42nd St., New York 18, N. Y.

AVAILABLE CENTRIFUGAL Engineer and designer with modern engineering practice, including knowledge of standardization of products. Engineering training and experience covers wide field. PW-994, Power, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER, age 42, professional license state of Washington, with 18 years experience in steam plant operation, steam and electrical utilization equipment installation, operation, and maint., plant supervision, sales work, cost analysis of electrical and steam services, desires permanent industrial connection in Western United States. Will furnish references. PW-108, Power, 520 N. Michigan Ave., Chicago, 11, Ill.

ELECTRICAL ENGINEER: age 33. Desires position as plant engineer or superintendent of electrical maintenance. Broad experience in power and industrial plant maintenance. Present position is in the inspection and engineering of power plant equipment. PW-109, Power, 520 N. Michigan Ave., Chicago 11, Ill.

HEAT TRANSFER Engineer desires position in charge of department for thermal design, mechanical design and cost estimating of heat transfer equipment. Excellent opportunity for reliable manufacturer to enter exchanger field and guarantee thermal and mechanical performance. Chemical engineer, 28, honor graduate, 5 years experience in thermal and mechanical design, cost estimating. Participating in development of heat transfer and fluid flow theory and design. Abreast of latest developments in field. PW-110, Power, 330 W. 42nd St., New York 18, N. Y.

ENGINEERING GRADUATE: with 7½ years experience in power plant installations and hydraulic control systems. Desires position with firm designing industrial hydraulic equipment and systems; or power plant layout and equipment designs and installations. PW-111, Power, 330 W. 42nd St., New York 18, N. Y.

ENGINEER-MECHANICAL-Electrical, Technical graduate. 20 years experience in design, construction, operation, maintenance. Desires position as operating or maintenance engineer in utility, or large refrigerating, ice, cold storage, air conditioning, dairy or industrial plants. United States or foreign considered. Member: American Society Industrial Engineers, American Society Design Engineers, American Society Refrigerating Engineers, etc. PW-112, Power, 520 N. Michigan Ave., Chicago 11, Ill.

INSTRUMENT AND controls—4½ years experience with flow meters, temperature recorders, draft gauges, water level recorders, etc. Regulators and combustion controls. Most experience with republic flow meters company equipment. Can furnish good references. PW-113, Power, 330 W. 42nd St., New York 18, N. Y.

## SELLING OPPORTUNITY WANTED

EXPERIENCED SALES Engineer desires position representing American firm in China. Graduate Engineer, full command of Chinese languages. RA-114, Power, 520 N. Michigan Ave., Chicago 11, Ill.

**SUBSTATION**

**MAINTENANCE MAN**

Wanted by utility company, substation maintenance man, should be familiar with substation equipment and with inspection and maintenance of small hydro plants—location, Madison, Wisconsin.

Submit details of experience, education, and ability to

*PERSONNEL DEPARTMENT*

**WISCONSIN POWER & LIGHT CO.**
**MADISON, WISCONSIN**

WANTED

**DESIGNERS**
**ARCHITECTURAL**
**STRUCTURAL**
**POWER PIPING**
**ELECTRICAL**

5 to 10 yrs. experience required in Power Plant or Heavy Industrial Structures. Positions in Philadelphia

**United Engineers & Constructors Inc.**
**1401 Arch St. Phila. 5, Pa.**

WANTED

**General Plant Superintendent**

Power Company operating interconnected system with numerous plants in three states in North Central United States is looking for experienced man, age 40 to 50 years, to supervise operations and maintenance all plants. Must be executive type with technical training in combustion and mechanical engineering and broad operating experience in steam power plants. Diesel and water power experience desirable. Headquarters in city of 12,000. Considerable traveling around territory necessary. Permanent and highly responsible position with locally controlled and operated Company for right man. Applicants should state complete history of experience and education, previous positions held and duration, with reasons for changes. Include photograph and references. State salary expected.

**OTTER TAIL POWER COMPANY**
**Fergus Falls, Minnesota**

**WANTED**

**POWER PLANT**

Switchboard and turbine operators, mechanics, asbestos workers and firemen for permanent positions in large plant in vicinity of Richmond, Virginia. No labor troubles. Wages comparable with those in area. State availability with complete details of experience.

**P-986, Power**
330 W. 42nd St., New York 18, N. Y.

WANTED

**Young Electrical Engineers**

For work in Engineering Department of Electric Utility Company. State full details as to experience.

**OTTER TAIL POWER COMPANY**
**Fergus Falls, Minnesota**

**WANTED—SUPERINTENDENT OF POWER**

28-35 Mechanical or electrical graduate. Must have previous experience in power plant maintenance and operation, and the design and construction of power distribution systems. Location: India. State age, experience, marital status, details of education, present salary and salary expected. Send photograph.

P-972, Power
330 West 42nd St., New York 18, N. Y.

**Man Wanted for Industrial Sales Promotion & Development Work**

A capable sales-minded young or middle aged man with experience in promotion work can find an outstanding opportunity to make a real place for himself in the Sales Department of an internationally known industrial manufacturer. Engineering training or experience will be helpful. If you think you have the ability to take over such a sales promotion assignment and would like to live in a good, small midwestern town, then write to us and we'll tell you more about this opportunity. Write Personnel Manager

**A. P. GREEN FIRE BRICK CO.**
**MEXICO, MISSOURI**

WANTED

## PRODUCTION ENGINEER

This is a real opportunity for a man with experience and some general knowledge of the food packing industry. The job is Production Engineering for a food specialty concern manufacturing both canned and packaged products, located in New York State. The man we want has had experience in:

- Production Engineering
- Canning and packaging equipment maintenance and construction
- High pressure boiler equipment
- Building maintenance and construction

We are willing to pay this man what he is worth. Write, giving full particulars regarding education, experience, salary expected, to

P-998, Power
330 West 42nd St., New York 18, N. Y.

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**YOU** may be relieved of much worry and unnecessary expense.
**YOUR** company (its personnel intact, as a rule) will gain the benefit of added capital, plus the expert management of an experienced, reputable operating organization.
**THERE** is profit in it for all. As principals (not brokers) with substantial finances and a background of long experience, we are interested in industrial plants.

● *ALL consultations and negotiations strictly confidential*

**Box 1234—1474 Broadway, N. Y.**

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POWER PLANT EQUIPMENT

## INSPECTOR

A large middle west utility has an opening for an experienced practical steam power plant installation engineer who is capable of inspection work in manufacturer's plants, and is familiar with erection and correct alignment of all types of mechanical equipment in steam power plants. Shop experience and knowledge of shop fabrication and inspection essential. State in detail experience, education, age and salary expected.

P-997, Power
520 N. Michigan Ave., Chicago 11, Ill.

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## NEW PRODUCTS WANTED

Our client, an established manufacturer, wants new products or new ideas that might be developed into new products.

Experienced in steel casting, welding and machining in any combinations—large sizes, great precision.

Selling industrial and manufacturing markets.

Please write Dept. 10. Communications in confidence. We are fully compensated by our client.

**CHARLES H. WELLING & CO., INC.**
**52 Vanderbilt Ave., New York 17, N. Y.**
***New Products—New Processes***

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This amazingly practical and authoritative book shows how you can start now to place yourself NEXT IN LINE FOR PROMOTION and headed for future success! It shows what present-day business requires of you, gives dozens of pointers and how you can apply them to overcome your short-comings, shows how to make good on what you do so as to stand out in competition with others. Do you want to be there when the promotions are handed out? Then send for this stimulating and helpful book today; see exactly how it prepares you to capitalize on your merit, win respect and promotion on your job.

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**McGRAW-HILL BOOK CO., Inc.**
**330 W. 42 St. New York 18**

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***Wanted—CHIEF ENGINEER***

Take complete charge of power plant of large board mill. Location Middle West. Unusual opportunity for right party. Apply in own handwriting giving references, experience, age and other pertinent information. Address

P-985, Power
520 N. Michigan Ave., Chicago 11, Ill.

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WANTED

## SALES AGENTS

For established industrial Stokers and Soot Blowers in Boston, Philadelphia, Baltimore, Syracuse, Buffalo, Elmira, Pittsburgh, Cleveland, Cincinnati. State age, experience and qualifications.

SW-999, Power
330 West 42nd St., New York 18, N. Y.

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WANTED

## EQUIPMENT ACCOUNTS

One or two additional accounts by experienced concern, able to sell, service, and erect power plant equipment. Minnesota and adjacent territory.

RA-100, Power
330 West 42nd St., New York 18, N. Y.

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## SALES ENGINEER

Familiar with power plants, to take full charge of long established branch office. This opening made available through the expansion of our business and promotions in our organization. Locations Chicago, Philadelphia, or Detroit.

**The Dampney Company of America**
**Hyde Park, Boston 36, Mass.**

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- Specialists in isometric and perspective drawings, cutaways, exploded views, schematics, line and airbrush illustrations from plans, sketches or actual parts.
- For technical reports, charts, data sheets, service manuals, catalogues, etc.
- Commitments accepted within 200 mile radius from N. Y.
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## TRANSFORMER MANUFACTURER

***Wishes to Sell***

**Stock inventory, patterns, trade-name, manufacturing equipment, etc. etc.**

**Sizes from ½ to 5000 KVA**

Detailed information available to principals or accredited representatives on request to

**BO-104,** Power,
330 W. 42nd St., New York 18, New York

# IMMEDIATE DELIVERIES NEW EQUIPMENT

## DIESEL GENERATOR SETS

50—75 KVA—General Electric—General Motors Engines Model 6-71, 3 phase, 50/60 cycle, 220 volt, 1200 RPM; Radiator Starting Battery

50—37.5 KVA Century—International Model UD 3 phase 5060 cycle 220 volt 1200 RPM complete

50—31 KVA General Electric-International Model UD 3 phase 50/60 cycle 1200 RPM 220 volt

16—18.75 KVA General Electric-International Model UD 3 phase 50/60 cycle 220 volt 1200 RPM

## NEW PACKAGE POWER PLANT

6000 KW complete Power Plant consists of

4—Foster Wheeler Boilers with Superheaters, Economizers, Oil Burners, all accessories; 450 lb. pressure

3—2000 KW Westinghouse Turbo-Generators 3 phase 50 cycle 6900/380 volt; Switchboards, Transformers, Surface Condensers, all accessories.

## REBUILT TURBO GENERATORS

50 KW to 5000 KW A.C. and D.C. Condensing and Non-Condensing.

Advise your requirements.

## NEW CENTRIFUGAL PUMPS

One of the largest stocks of new Pumps of all types in the country.

Advise Capacity (GPM) Head (Ft) and electrical specification.

Also Rebuilt Pumps all types.

## NEW-ELECTRIC MOTORS-REBUILT

Thousands of A.C. and D.C. Motors all sizes and types in stock and on back orders—New stocks up to 100 H.P. Rebuilt to 1000 H.P.

Advise Requirements.

## AIR COMPRESSORS
## 2 STAGE SYNCHRONOUS MOTOR DRIVEN

| CFM | Make | Size | R.P.M. | H.P. | Max. Press. |
|---|---|---|---|---|---|
| 782 | Ingersoll-Rand | 15 x 9½ x 10 | 360 | 125 | 100 |
| 862 | Chicago Pneumatic | 14¼ x 9½ x 7 | 585 | 150 | 100 |
| 1302 | Chicago Pneumatic | 20 x 12 x 14 | 257 | 225 | 125 |
| 1545 | Ingersoll-Rand | 21 x 13 x 14 | 277 | 275 | 100 |
| 1850 | Chicago Pneumatic | 23 x 13 x 14 | 277 | 350 | 125 |
| 2195 | Ingersoll-Rand | 26 x 16¼ x 18 | 200 | 350 | 100 |
| 3078 | Ingersoll-Rand | 30 x 18 x 21 | 180 | 500 | 100 |

## SINGLE STAGE V-BELT DRIVEN

| | | | | |
|---|---|---|---|---|
| 67 | Chicago Pneumatic | 6 x 6 | 350 | 150 |
| 110 | Pennsylvania | 7 x 5 | 500 | 60 |
| 173 | Ingersoll-Rand | 9 x 8 | 300 | 100 |
| 215 | Ingersoll-Rand | 10 x 8 | 300 | 75 |
| 311 | Chicago Pneumatic | 12 x 8 | 300 | 45 |
| 350 | Worthington | 11 x 12 | 270 | 100 |
| 368 | Sullivan | 12 x 10 | 285 | 100 |
| 528 | Ingersoll-Rand | 14 x 12 | 250 | 100 |
| 528 | Pennsylvania | 14 x 12 | 250 | 100 |

## TWO STAGE BELT DRIVEN AND DIRECT CONNECTED

| | | | | |
|---|---|---|---|---|
| 327 | Ingersoll-Rand | 11 x 7 x 10 | 300 | 100 |
| 877 | Ingersoll-Rand | 17 x 10½ x 14 | 240 | 100 |
| 1085 | Chicago Pneumatic | 19 x 11 x 12 | 277 | 100 |
| 1302 | Ingersoll-Rand | 20 x 12½ x 16 | 257 | 100 |

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When used equipment is rebuilt in the Hemphill Shops it is rebuilt to the same HIGH STANDARDS of workmanship and performance as those of the original manufacturer. All Hemphill rebuilding and testing is done under the supervision of Electrical Engineers. This is a *plus-value* you get in Hemphill Equipment.

**HEMPHILL VALUES ARE PREJUDGED**


### MOTOR GENERATOR SETS

1—150 KW. 125 Volt Westinghouse, Squirrel Cage
2—100 KW. 250 Volt General Electric, 440 volt, 3 phase, 1200 RPM. Sq. Cage
1—75 KW. 125 Volt General Electric, Squirrel Cage

### TURBO GENERATORS

1—600 KW. Terry dual bleeder condensing Turbine only
1—300 KW. 125/250 Volt General Electric non-condensing
1—300 KW. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—200 KW. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—30 KW. 125 volt, Allis-Chalmers, non-cond.

### ALTERNATORS

1—500 KW. 3600 RPM. 600 volt, General Electric D.C. exciter
1—200 KVA 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter
1—180 KW. 514 RPM. 550 volt, Westinghouse
1—165 KW. 514 RPM. 2400 volt, Electric Mach.
1—150 KW. 900 RPM. 2300 volt, General Electric, type ATB
1—62½ KW. 3600 RPM. 220 volt, Allis-Chalmers
1—40 KW. 1800 RPM. 550 volt, General Electric
1—35 KW. 1200 RPM. 240 volt, Columbia Electric D.C. exciter
1—31.3 KVA. 1200 RPM. 120/208 volt, American D.C. exciter
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter

### MOTORS—VARIABLE SPEED
#### 230 VOLTS

2—200 H.P. 425/212 RPM. General Electric MPC
2—100 H.P. 950/1170 RPM. General Electric RC-37
1—60 H.P. 500/1000 RPM. Diehl
1—40 H.P. 700/1000 RPM. Sprague L.C.
1—30 H.P. 400/1200 RPM. General Electric R' C-204
1—30 H.P. 225/900 RPM. Crocker Wheeler CMC
1—25 H.P. 650/2200 RPM. Westinghouse SK-110L.
1—25 H.P. 500/1500 RPM. General Electric RF-12
1—25 H.P. 400/1200 RPM. Westinghouse SK
2—25 H.P. 300/900 RPM. Electro Dynamic
1—15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM. Electro Dynamic
3—11½ H.P. 500/1500 RPM. Westinghouse
1—7½/10 H.P. 500/1500 RPM. Reliance
1—6/7.5 H.P. 450/1800 RPM. Crocker Wheeler CMC
1—5 H.P. 500/1500 RPM. Reliance
1—5 H.P. 600/1200 RPM. General Electric LC
1—5 H.P. 450/1800 RPM. Crocker Wheeler CM
1—5 H.P. 400/1600 RPM. Diehl K6
1—5 H.P. 225/900 RPM. Electro Dynamic

### TRANSFORMERS

1—1000 KVA. Auto Transf. 4150 V. 3 Ph. 4 wire to 2406 V. 2 Ph.
2—400 KVA. General Electric, 4156-250/480 volt, Scott taps
3—150 KVA. General Electric 33000/2300/4000Y
3—150 KVA. General Electric 2200/220/440 volt
1—100 KVA. General Electric 2200/220/440 volt
3—100 KVA. Westinghouse 11430/250 volt
3—100 KVA. General Electric 13200/250 volt
3— 75 KVA. General Electric 13500/750/440 volt
1— 75 KVA. General Electric, 3 phase, 4156Y-120/208Y
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.
2— 15 KVA. General Electric 2300-115/230 volt

### GASOLINE DRIVEN
### D. C. GENERATOR SETS

2—25 KW. 125 volt
1—30 KW. 125 volt
1—120 KW. A.C. 240 volt, 3 phase

### MOTORS 3 PHASE 60 CYCLE
#### SQUIRREL CAGE

1—400 H.P. 1200 RPM. Westinghouse 220 volt
1—150 H.P. 1750 RPM. General Electric 1K 440 volt
1—150 H.P. 870 RPM. General Electric HI-15 220 volt
1—150 H.P. 720 RPM. General Electric 1K 440 volt
1—150 H.P. 400 RPM. General Electric 1-17 440 volt
1—125 H.P. 1750 RPM. Cont. Electric 2200 volt
2—100 H.P. 1800 RPM. General Electric IK 440 volt
1—100 H.P. 425 RPM. General Electric HI-16 440 volt
1— 90 H.P. 380 RPM. Crocker-Wheeler 550 volt
1— 75 H.P. 870 RPM. Allis-Chalmers ARZ 220 volt
1— 75 H.P. 690 RPM. Westinghouse 550 volt
1— 60 H.P. 900 RPM. Howell Mfs. Co. SC. 220 volt
2— 50 H.P. 900 RPM. Fairbanks-Morse H. 220 volt
1— 50 H.P. 695 RPM. General Electric IK 220 volt
1— 50 H.P. 680 RPM. Westinghouse 220 volt
2— 50 H.P. 565 RPM Westinghouse 440 volt
1— 50 H.P. 575 RPM. General Electric IK 220 volt
1— 50 H.P. 514 RPM. General Electric IQK 220 volt

### MOTORS 3 PHASE 60 CYCLE
#### SLIPRING

1—500 H.P. 900 RPM. Lincoln 440 volt
1—350 H.P. 293 RPM. General Electric MT-424 440 volt
1—250 H.P. 600 RPM. General Electric IM 2200 volt
1—225 H.P. 1800 RPM. General Electric I-E 220 volt
1—200 H.P. 600 RPM. Crocker Wheeler S.R. 440 volt
1—200 H.P. 600 RPM. Westinghouse CW 220 volt
1—150 H.P. 1750 RPM. Westinghouse CW 220 volt
1—100 H.P. 720 RPM. General Electric IM 220 volt
1—100 H.P. 720 RPM. Westinghouse CW 440 volt
1—100 H.P. 695 RPM. General Electric IM 440 volt
1— 75 H.P. 900 RPM. Allis-Chalmers 2K 220 volt
1— 75 H.P. 900 RPM. General Electric ITC 220 volt
1— 75 H.P. 690 RPM. Allis-Chalmers 220 volt
1— 75 H.P. 570 RPM General Electric IM 220 volt
1— 60 H.P. 575 RPM. Allis-Chalmers 220 volt
1— 50 H.P. 900 RPM. General Electric IM 220 volt
1— 40 H.P. 1150 RPM. Cont. Electric SA85 220 volt
1— 40 H.P. 1130 RPM. General Electric MT 2200 volt

### MOTORS D. C. 230 VOLTS

2—450 H.P. General Electric MPL 250 volt 400 RPM.
1—250 H.P. 750 RPM Electro Dynamic 230 volt
1—100 H.P. 625 RPM. General Electric-Sprague LC 230 volt
1— 80 H.P. 600 RPM. Crocker-Wheeler CMC 230 volt
1— 75 H.P. 575 RPM. General Electric C 230 volt
1— 66 H.P. 535 RPM. Crocker Wheeler SCM 230 volt
4— 50 H.P. 700 RPM. Crocker Wheeler CM 230 volt
2— 30 H.P. 1150 RPM. General Electric RC-31 230 volt
1— 30 H.P. 1100 RPM. General Electric RC-12 230 volt
1— 30 H.P. 750 RPM. General Electric RC-14 230 volt
1— 30 H.P. 725 RPM. Westinghouse SK 230 volt
1— 30 H.P. 625 RPM. General Electric C 230 volt
1— 25 H.P. 1150 RPM. General Electric CD-93 230 volt
1— 25 H.P. 775 RPM. General Electric RC-13 230 volt
1— 25 H.P. 775 RPM. General Electric RC 230 volt
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt
1— 20 H.P. 800 RPM. General Electric RC-12 230 volt
1— 15 H.P. 1750 RPM. General Electric CD-67 230 volt
1— 15 H.P. 350 RPM. Diehl G-312 230 volt


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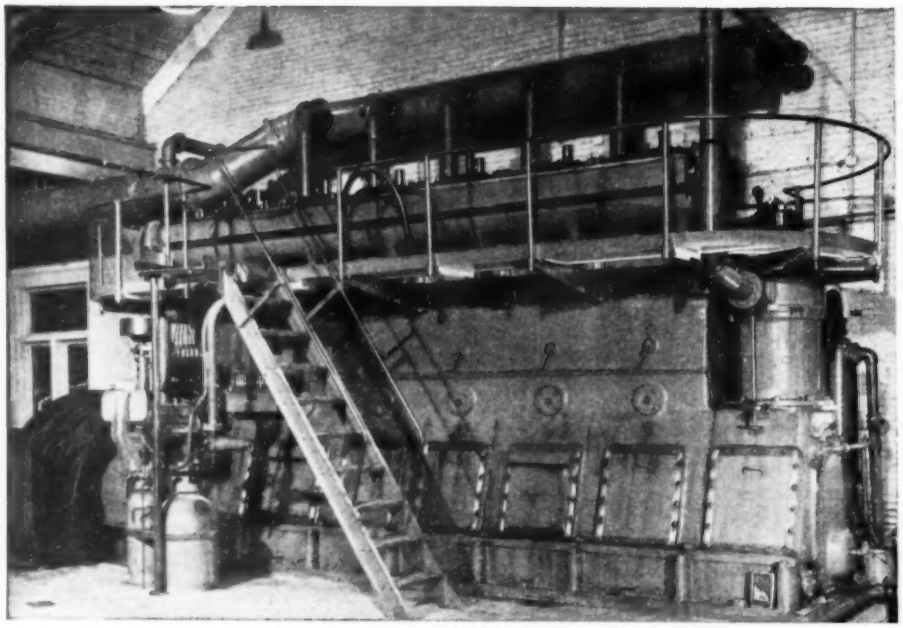
# POWER PLANT MACHINERY



1000 KVA Ideal generator 3 phase 60 cycle 2300/4000 volts, 300 RPM direct connected to 1200 HP McIntosh & Seymour 6-cylinder diesel engine, 4-cycle, 300 RPM.

*Installed new 1930. Excellent condition.*

*Can be shown in operation.*

Actual Photograph
1000 KVA MC INTOSH & SEYMOUR DIESEL ENGINE GENERATOR UNIT

## TURBINE UNITS

**3 phase 60 cycle**

12500 KVA Wstg. 2400 V. Cond. 200#
10000 KVA G.E. 4000 V. Cond. 200#
6250 KVA G.E. 2300 V. Cond. 175#
5000 KVA G.E. 4000 V. Cond. 200#
3750 KVA G.E. 480 V. Cond. 200#
2500 KVA Wstg. 2300 V. Cond. 200#
1875 KVA G.E. 2300 V. Non. 175#
1563 KVA Kerr 2300 V. Non. 200#
1250 KVA Allis 480 V. Bleed. 250#
625 KVA Allis 240 V. Non. 125#
625 KVA Westg. 480 V. Bleed. 150#

## UNIFLOW UNITS

**3 phase 60 cycle**

750 KVA Skinner 2300 V. 200#
675 KVA Ames 480 V. 150#
625 KVA Chuse 480 V. 150#
375 KVA Skinner Vert. 240 V. 150#
312 KVA Chuse 480 V. 150#
250 KVA Ames Vert. 240 V. 150#
240 KVA Nordb. 2300 V. 150#
225 KVA Chuse 2300 V. 150#
150 KVA Ames 240 V. 150#
120 KVA Ames 240 V. 165#
60 KVA Ames 240 V. 150#

## DIESEL UNITS

**3 phase 60 cycle**

625 KVA Bus. Sul. 2300 V. 180 RPM
500 KVA Fair.Mor. 2300 V. 257 RPM
437 KVA Bus.Sul. 2300 V. 200 RPM
375 KVA DeLav. 2300 V. 300 RPM
350 KVA Fair.Mor. 2300 V. 300 RPM
300 KVA Fair.Mor. 2300 V. 257 RPM
250 KVA Chic. Pn. 240 V. 600 RPM
200 KVA Fair.Mor. 2300 V. 257 RPM
175 KVA Buckeye 240 V. 450 RPM
163 KVA Worth. 2300 V. 327 RPM
156 KVA Buckeye 240 V. 514 RPM

## WATER TUBE BOILERS

1300 HP Springfield 400# Pulverizer
1000 HP Sterling 200# Pulverizer
750 HP Sterling 250# Stoker
484 HP Springfield 200# Oil Burners
400 HP Sterling 250# Stoker

## UNIFLOW UNITS

**Direct Current**

600 KW Skinner Vert. 250 V. 150#
300 KW Skinner 250 V. 150#
200 KW Skinner 125 V. 125#
150 KW Ames 250 V. 125#

## MOTOR GENERATORS

**3 phase 60 cycle**

400 KW G.E. Syn. 275 D.C. 440 A.C.
300 KW C.W. Syn. 125 D.C. 4000 A.C.
200 KW G.E. Syn. 275 D.C. 2300 A.C.
150 KW Wst. Syn. 275 D.C. 440 A.C.

## INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

Let's get down to Belyea Brass Tacks

WHAT BELYEA RE-NU-BILT SIGNIFIES

Here Is A List of Today's RE-NU-BILT EQUIPMENT . . .

Because WE Own It . . .

. . . YOU Get It Quicker

You get RE-NU-BILT Equipment with minimum delay because we *own* what we advertise. We do not have to use up time for negotiation after your order is placed. Our workmen have been specially trained to rebuild electrical power equipment and therefore do the rebuilding in a minimum time.

. . . With A Guarantee of SUCCESSFUL OPERATION

## MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW GE 275 v. D.C. to 2150 HP—2200/4400 v. Syn. Motor with exciter.
1—300 KW Whse. 600 v. D.C. to 450 HP, 2300 v. Syn. with exciter.
1—175 KW. Whse. 250 v. D.C. to 312 Kva., 2300 v. Syn. with exciter.
2—150 KW. Whse. 600 V. D.C. to 200 HP—2200 V.
1—150 KW Whse. 3 unit (2) 75 KW 125 V. Gen. D.C. to 200 HP—2300 V. Ind.
1—75 KW GE 125 V. D.C. to 120 HP—2300/4000 V. Ind.
1—50 KW GE 125 V. D.C. to 75 HP—2300/4000 V. Ind.
1—26.4 KW W.E. 33 v. 800 amp. D.C. to 41.5 HP 220 v. Sq. Cg.
1—19 KW W.E. 33 v. 600 amp. D.C. to 32 HP. 220 v. Sq. Cg.

**SPECIAL**

**1—500 KW—GE 250 V D.C. to 700 HP—2300/4150 Syn. Motor—3 phase—25 cycle with Controls.**

## TRANSFORMERS—60 Cycle

| Qu. | Kva. | Make | Ph. | Type | Voltages |
|---|---|---|---|---|---|
| 3 | 1667 | Pitts. | 1 | OISC | 13200x2300 |
| 1 | 1050 | G.E. | 3 | WCTH | 11000x445/222½ |
| 4 | 525 | G.E. | 1 | HJ | 2300x445 |
| 4 | 500 | Pitts. | 1 | OISC | 13200x2300 |
| 2 | 333 | Pitts. | 1 | OISC | 2400x220 |
| 1 | 300 | Pitts. | 3 | OISC | 4150x208/120 |
| 3 | 200 | G.E. | 1 | HLLD | 27600x115/460 |
| 2 | 200 | G.E. | 1 | HKDD | 13800x220/440 |
| 1 | 200 | Whse. | 1 | JK | 6600x220/440 |
| 3 | 200 | G.E. | 1 | HJ | 2300x408/204 |
| 1 | 200 | G.E. | 2-3 | Auto | 2500x2500 |
| 1 | 125 | Maloney | 1 | C | 2300x230/460 |
| 3 | 100 | G.E. | 1 | HJDD | 13200x445/226 |
| 3 | 100 | Whse. | 1 | OISC | 13200x250 |

## A. C. MOTORS

3 phase—60 cycle

SLIP RING

| Qu. | H.P. | Make | Volts | R.P.M. | Desc. |
|---|---|---|---|---|---|
| 1 | 2500 | G.E. | 6600 | 253 | MT |
| 1 | 800 | Al. Ch. | 440 | 885 | ANY |
| 1 | 600 | Cr. Wh. | 2200 | 507 | 131 AQ |
| 1 | 600 | G.E. | 2300 | 600 | MT-422-3 Brg. |
| 1 | 600 | Whse. | 440 | 400 | CW |
| 1 | 500 | Al. Ch. | 2200 | 590 | ANY-36 |
| 1 | 400 | G.E. | 2200 | 252 | IP |
| 1 | 400 | Cr. Wh. | 440 | 590 | 29Q |
| 1 | 350 | G.E. | 4000/2300 | 252 | MT-442Y |
| 1 | 300 | G.Q. | 220/440 | 585 | IM |
| 1 | 250 | G.E. | 4000 | 257 | MT-424Y |
| 1 | 225 | G.E. | 550 | 720 | IM-17 |
| 1 | 200 | G.E. | 440 | 450 | IM-3 Brg. |
| 1 | 200 | G.E. | 2200 | 600 | IM |

SQUIRREL CAGE

| | | | | | |
|---|---|---|---|---|---|
| 1 | 400 | G.E. | 2200 | 1175 | IE-15B |
| 1 | 300 | G.E. | 440 | 900 | IK |
| 1 | 200 | Whse. | 2200 | 1800 | C8 |
| 1 | 200 | G.E. | 550 | 580 | IK |
| 1 | 200 | G.E. | 2200 | 490 | IK |
| 2 | 200 | G.E. | 2300 | 1175 | IK |
| 1 | 200 | G.E. | 440 | 580 | IK |
| 1 | 200 | Al. Ch. | 2300 | 1175 | |
| 2 | 175/112 | G.E. | 440 | 900/720 | IK |
| 1 | 150 | Whse. | 550 | 400 | CS-594A |
| 3 | 150 | G.E. | 440 | 1200 | K-6325S B. Brg. |

SYNCHRONOUS

| | | | | | |
|---|---|---|---|---|---|
| 2 | 2100 | G.E. | 2200/4400 | 514 | ATI |
| 1 | 600 | Al. Ch. | 2200 | 720 | |
| 1 | 75 | G.E. | 220 | 600 | TS-7556 |

SYNCHRONOUS CONDENSER

| | | | | | |
|---|---|---|---|---|---|
| 1 | 5000 | Whse. | 2300/4000 | 900 | |

## ROTARY CONVERTERS

3 PHASE—60 CYCLE

| Qu. | Kw. | Make | Speed | D.C.V. | Trans. V. |
|---|---|---|---|---|---|
| 1 | 1500 | Whse. | 720 | 600 | 2300 |
| 1 | 1500 | Whse. | 600 | 600 | 11500 |
| 1 | 1250 | G.E. | 720 | 250 | 2300 |
| 1 | 1000 | G.E. | 900 | 600 | 13200 |
| 1 | 1000 | Whse. | 900 | 600 | 11000 |
| 1 | 750 | Whse. | 720 | 250 | 6600/2300 |
| 1 | 500 | Whse. | 1200 | 600 | 13200/2300 |
| 1 | 375 | Whse. | 720 | 250 | 6600/2300 |
| 1 | 300 | G.E. | 1200 | 600 | 2300 |

3 PHASE—25 CYCLE—BOOSTER TYPE

| | | | | | |
|---|---|---|---|---|---|
| 2 | 1500 | G.E. | 500 | 226-275 | 13200/6600 |

All units can be furnished with A. C. & D. C. control

**SPECIAL**

**1—2000 amp., 3 pole, 15000 V. Condit type F-120-15 D, 230 V Sol operated OCB —1000 000 uninterrupting Capacity.**

## D. C. MOTORS

| Qu. | H.P. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 2 | 1250 | G.E. | MPC | 500 | 130 |
| 1 | 800 | G.E. | MPC | 550 | 600 |
| 2 | 700 | G.E. | MCF | 600 | 150/525 |
| 1 | 650 | G.E. | MPC | 250 | 115/145 |
| 2 | 625 | G.E. | MPC | 500 | 130 |
| 1 | 500 | G.E. | MPC | 230 | 900 |
| 3 | 350 | G.E. | MPC | 230 | 450 |
| 1 | 300 | G.E. | MPC | 230 | 275/550 |
| 2 | 300 | Cr. Wh. | CCM-151H | 230 | 630/700 |
| 1 | 250 | G.E. | MPC | 230 | 400/500 |
| 1 | 250 | Al. Ch. | | 230 | 525 |
| 1 | 250 | Whse. | SK | 230 | 275/690 |
| 1 | 200 | Whse. | SK-191 | 230 | 850 |
| 2 | 135/175 | G.E. | MCF | 230 | 750/1050 |
| 1 | 150 | G.E. | MPC | 230 | 250/450 |
| 2 | 130 | Cr. Wh. | CMC-65H | 550 | 1200 |
| 2 | 125 | G.E. | CO-1832 | 230 | 625 |

## INDUCTION VOLTAGE REGULATORS

6—17¼ KVA, 1 phase, 2300 V. GE type IRS form **F-73**, Motor operated, automatic.
6—30 KVA, 3 phase, 2300 v. GE type IRT form **F-73**, motor operated, automatic.

***Have You Surplus Electrical Equipment?*** **WE BUY FOR STOCK — FOR CASH.**

Belyea

38TH YEAR OF SERVICE

COMPANY, INC.

*Main Office & Shop*

43 HOWELL ST., JERSEY CITY, N. J.

"SUCCESSFUL OPERATION GUARANTEED"

# Dependable Rebuilt Electrical Equipment

## 1 YEAR GUARANTEE

### 3 Ph. Squirrel Cage Motors

| Qu. | H.P. | Make | | Speed |
|---|---|---|---|---|
| 4 | 150 | G.E. | KT-547S | 1750 |
| 6 | 150 | West. | CS-771.18 | 1755 |
| 1 | 125 | West. | CS | 1150 |
| 1 | 125 | West. | CS | 690 |
| 1 | 147 | West. | 25 cyc. | 715 |
| 2 | 100 | G.E. | BTA-440V. | 375/750 |
| 1 | 100 | G.E. | KT-500 | 1150 |
| 1 | 100 | West. | CS | 575 |
| 1 | 90 | Burke | EM7 | 1150 |
| 3 | 75 | G.E. | IK | 690 |
| 1 | 75 | West. | CS | 690 |
| 1 | 70 | G.E. | Synch. | 1200 |
| 1 | 85 | G.E. | FT-529 | 3600 |
| 1 | 75 | G.E. | 2300 V. | 1800 |
| 1 | 75 | West. | CCL | 870 |
| 1 | 75 | Al. Ch. | | 860 |
| 1 | 60 | Burke | | 575 |
| 3 | 60 | G.E. & West. | | 690 |
| 1 | 50/25 | G.E. | KG-504 | 1750/885 |
| 1 | 50 | El. Dyn. | 174BK | 1750 |
| 1 | 50 | G.E. | KT-326 | 1750 |
| 1 | 50 | Star | A-75 | 1750 |
| 2 | 50 | Al. Ch. | | 1160 |
| 1 | 50 | West. | CCL | 1150 |
| 1 | 50 | Cr. Wh. | 1220 | 1150 |
| 1 | 50 | G.E. | KT-342 | 865 |
| 1 | 50 | Cr. Wh. | 122Q | 865 |
| 1 | 50 | G.E. | KT-346 | 690 |
| 1 | 50 | West. | CS | 580 |
| 1 | 50 | G.E. | I-14 | 495 |
| 1 | 46 | W. E. | | 150/900 |
| 1 | 40 | G.E. | KT-332 | 1140 |
| 2 | 40 | G.E. | KT-336 | 860 |
| 1 | 40 | Triumph | TR | 690 |
| 1 | 40 | G.E. | KT-346 | 690 |
| 1 | 40 | W.E. | | 150/900 |
| 2 | 35 | West. | 25 cyc. | 1450 |
| 1 | 35 | Wagner | | 850 |
| 1 | 35 | West. | CS | 685 |
| 1 | 30 | U.S. | Vert. | 3450 |
| 1 | 30 | Cr. Wh. | | 870 |
| 1 | 30 | Watson | | 850 |
| 1 | 30 | West. | CS | 850 |
| 1 | 30 | West. | CCL | 690 |
| 1 | 25 | G.E. | KT-503 | 1750 |
| 1 | 25 | Triumph | BL-118 | 1750 |
| 1 | 25 | G.E. | KT-302 | 1735 |
| 1 | 25 | Wagner | Fy. Welch. | 1200 |
| 1 | 25 | Wagner | Vert. | 1160 |
| 1 | 25 | West. | CS-405 | 1160 |
| 5 | 25 | West. | CS | 1160 |
| 1 | 25 | Century | AS-35 | 870 |
| 1 | 25 | G.E. | IK | 870 |
| 1 | 25 | Wagner | Fy. Welch. | 720 |
| 1 | 25/12½ | G.E. | KR-445 | 840/405 |
| 1 | 20 | West. | CS-365 | 3400 |
| 1 | 20 | G.E. | KT-312 | 1700 |
| 1 | 20 | G.E. | Vert. | 1750 |
| 1 | 20 | West. | CS-365 | 1150 |
| 1 | 20 | R & M | K-207 | 1160 |
| 1 | 20 | West. | CS | 1150 |
| 2 | 20 | F-M | | 1150 |
| 1 | 20 | G.E. | Vert. | 1175 |
| 1 | 20 | Al. Ch. | | 870 |
| 1 | 20 | Diehl | | 860 |
| 1 | 20 | Al. Ch. | | 860 |
| 1 | 20 | West. | C. I. | 690 |
| 1 | 15 | G.E. | KT-752 | 1750 |
| 1 | 15 | Wagner | Fy. Welch | 1800 |
| 1 | 15 | El. Spec. | Synch. | 1800 |
| 1 | 15 | West. | CCL | 1750 |
| 1 | 15 | G.E. | KT-312 | 1150 |
| 1 | 15 | Howell | | 1150 |
| 1 | 15 | Al. Ch. | | 1150 |
| 1 | 15 | G.E. | KT-502 | 1170 |
| 1 | 15 | G.E. | Vert. | 1150 |
| 1 | 15 | Lincoln | | 1150 |
| 4 | 15 | West. | MS | 1150 |
| 2 | 15 | West. | CS-365 | 1160 |
| 1 | 15 | G.E. | Vert. | 870 |
| 1 | 15 | G.E. | KT-512 | 870 |
| 1 | 15 | Wagner | 15VPR | 860 |
| 1 | 15 | Wagner | Fy. Welch. | 720 |
| 12 | 15 | West. | 600, 900, 1200 | 1800 |
| 1 | 15 | West. | CS-504 | 415 |

**JUST RECEIVED**

**65—GEARED HEAD MOTORS**

**LATEST TYPE**

**½ H.P.—148 RPM.**

**¾ H.P.—148 RPM.**

**LATEST TYPE**

**G.E. & WEST. NAMA FRAME MOTORS**

**16— 1 H.P. 1150 RPM.**
**2— 3 H.P. 1750 RPM.**
**5— 5 H.P. 1750 RPM.**
**2— 5 H.P. 1150 RPM.**
**2— 7½ H.P. 1150 RPM.**
**2—10 H.P. 1150 RPM.**
**1—10 H.P. 850 RPM.**
**3—10 H.P. 3450 RPM.**
**2—20 H.P. 1750 RPM. TEFC**
**1—25 H.P. 1750 RPM. TEFC**
**1—30 H.P. 1750 RPM. TEFC**
**6—20 H.P. 1750 RPM.**
**2—50 H.P. 1750 RPM.**
**1—75 H.P. 1750 RPM.**

### 2 Ph. Squirrel Cage Motors

| Qu. | H.P. | Make | | Speed |
|---|---|---|---|---|
| 1 | 100 | West. | CS-663C | 1750 |
| 1 | 100 | G.E. | KQ-547 | 1155 |
| 1 | 70 | G.E. | Synch. | 1200 |
| 1 | 75 | G.E. | IQE | 1750 |
| 1 | 50 | Lincoln | C-15 | 870 |
| 1 | 50 | G.E. | IQ | 870 |
| 1 | 40 | Al. Ch. | | 870 |
| 1 | 35 | Al. Ch. | | 870 |
| 1 | 30 | West. | CCL | 1150 |
| 1 | 30 | Wagner | BP | 1140 |
| 1 | 25 | Burke | | 870 |
| 3 | 25 | G.E. | IQL | 1150 |
| 1 | 25 | West. | CCL | 1150 |
| 1 | 15 | F-M | | 1750 |
| 1 | 15 | Wagner | | 1750 |
| 1 | 15 | G.E. | KQ-502 | 1150 |
| 1 | 15 | West. | CS | 1155 |
| 1 | 15 | Al. Ch. | | 1130 |
| 1 | 15 | West. | CS-572 | 860 |
| 1 | 15 | G.E. | IQ | 690 |

### A.C. Slip Ring Motors

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 250 | G.E. | IM | 600 |
| 1 | 150 | Lincoln | | 600 |
| 1 | 150 | El. Dy. | L-263 | 1770 |
| 1 | 125 | Al. Ch. | | 695 |
| 1 | 112 | G.E. | ITC | 720 |
| 1 | 100 | G.E. | IM | 720 |
| 1 | 100 | F-M | BA | 720 |
| 1 | 79 | G.E. | IM | 1150 |
| 1 | 79 | West. | CW | 1170 |
| 3 | 75 | G.E. | MT-352 | 870 |
| 1 | 75 | Al. Ch. | Hoist | 575 |
| 1 | 64 | G.E. | MTO-552 | 585 |
| 1 | 60 | West. | CW-956A | 290 |

### A.C. Slip Ring Motors

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 50 | G.E. | IM | 720 |
| 1 | 50 | G.E. | MT | 600 |
| 1 | 52 | G.E. | ITC | 860 |
| 1 | 50 | Al. Ch. | | 865 |
| 1 | 50 | G.E. | MT-342 | 860 |
| 1 | 40 | F-M | BR | 1150 |
| 1 | 40 | West. | CW | 1150 |
| 1 | 40 | West. | HF | 850 |
| 1 | 40 | Lincoln | IXL | 690 |
| 1 | 40 | G.E. | MT-352 | 570 |
| 1 | 35 | Al. Ch. | | 870 |
| 1 | 35 | Burke | DMB-7 | 720 |
| 1 | 30 | G.E. | ITC | 1200 |
| 1 | 30 | G.E. | M-526 | 1150 |
| 1 | 30 | G.E. | MQ-332 | 870 |
| 1 | 30 | West. | CI-574A | 870 |
| 4 | 30 | West. | CI-582C | 870 |
| 2 | 30 | G.E. | MT-542 | 690 |
| 2 | 25 | Al. Ch. | | 870 |
| 1 | 25 | Howell | SRS-420 | 870 |
| 1 | 25 | G.E. | IM | 565 |
| 1 | 20 | West. | CW | 870 |
| 1 | 20 | G.E. | MT-332 | 600 |
| 1 | 15 | G.E. | MT-502 | 1130 |
| 1 | 15 | West. | CW | 870 |
| 1 | 15 | G.E. | MT-512 | 845 |
| 1 | 15 | Al. Ch. | | 680 |
| 2 | 15 | G.E. | ITC-5010 | 695 |
| 1 | 15 | G.E. | MQ-332 | 670 |

### A.C. Generators

| Qu. | K.W. | Make | Voltage | Speed |
|---|---|---|---|---|
| 1 | 150 | G.E. | 240/480 | 600 |
| 1 | 100 | West. | 240/480 | 600 |
| 1 | 50 | G.E. | 208/120 | 1200 |
| 1 | 50 | F-M | 240/480 | 1200 |
| 1 | 50 | El. My. | 208/120 | 900 |
| 1 | 30 | Burke | 220/440 | 900 |

### 230 Volt D.C. Motors

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 350 | West. | SK | 340/425 |
| 3 | 75 | West. | SK151 | 250/1000 |
| 1 | 75 | Burke | AM-158 | 575 |
| 1 | 60 | G.E. | C-Inter. | 480/1100 |
| 1 | 50 | West. | SK-150 | 550/1100 |
| 1 | 50 | G.E. | RC-19 | 400/1200 |
| 1 | 45 | Diehl | K-10 | 850 |
| 1 | 40 | G.E. | DLC | 1050 |
| 2 | 35 | West. | SK-120 | 1150 |
| 1 | 35 | G.E. | RLC-204 | 440/880 |
| 2 | 35 | West. | SK-160 | 400/800 |
| 1 | 30 | G.E. | RC-32 | 1100 |
| 1 | 30 | West. | SA | 500/1500 |
| 3 | 25 | G.E. | RC-31 | 1150 |
| 1 | 25 | West. | SK | 1100 |
| 1 | 25 | Reliance | 92T | 1150 |
| 1 | 25 | I-A | FNA-1043 | 900 |
| 1 | 25 | A-L | | 850 |
| 1 | 25 | Rel. | MS | 500/1500 |
| 1 | 25 | Rel. | H3 | 400/1200 |
| 1 | 25 | G.E. | RF | 400/1200 |
| 3 | 20 | G.E. | RF | 500/1500 |
| 1 | 20 | G.E. | RF | 400/1200 |
| 1 | 20 | G.E. | CD-83 | 1200 |
| 1 | 20 | R. & M. | | 1160 |
| 1 | 20 | G.E. | RC-11 | 1150 |
| 1 | 20 | El. Dyn. | 7½-S | 950 |
| 3 | 20 | West. | SK-110L | 750 |
| 1 | 20 | West. | Hoist | 700 |
| 1 | 20 | West. | SK-120 | 300/1200 |
| 1 | 15 | Rochester | | 3450 |
| 1 | 15 | West. | SK-83 | 1150 |
| 2 | 15 | G.E. | RC | 1150 |
| 1 | 15 | G.E. | CD-Vert. | 900 |
| 1 | 15 | G.E. | CD-85 | 850 |
| 2 | 15 | G.E. | RC-30 | 850 |
| 1 | 15 | Sprague | D | 700 |
| 1 | 15 | West. | SK | 675/1350 |
| 1 | 15 | West. | SK-100L | 600/2500 |
| 1 | 9 | L-A | Baler | 1750 |
| 4 | 10 | G.E. | RC | 1150 |
| 2 | 10 | G.E. | CD-75 | 1150 |
| 1 | 10 | Diehl | | 900 |
| 1 | 10 | G.E. | RC | 29/850 |
| 1 | 10 | G.E. | CD-83 | 850 |
| 1 | 10 | Roth | | 800 |
| 1 | 10 | Diehl | LS-14 | 750 |
| 1 | 10 | West. | Elevator | 700 |
| 1 | 10 | G.E. | CVC | 700 |
| 1 | 10 | West. | SK | 600/1200 |
| 1 | 10 | G.E. | RLC | 500/1500 |
| 1 | 10 | West. | SK | 500/1500 |

### 230 Volt D.C. Motors

| Qu | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 10 | El. Dyn. | | 450/1800 |
| 2 | 10 | G.E. | RF-10 | 400/1600 |
| 2 | 10 | West. | SA | 400/1200 |
| 1 | 10 | West. | SK-90 | 400/1200 |
| 1 | 10 | Diehl | | 200/247 |
| 1 | 7½ | Sturt. | TF | 3600 |
| 1 | 7½ | El. Dyn. | 2S | 1750 |
| 1 | 7½ | G.E. | RC | 1150 |
| 6 | 7½ | West. | SK-40 | 1180 |
| 1 | 7½ | G.E. | CO-1804 | |
| 1 | 8 | L-A | Baler | 1200 |
| 2 | 7½ | West. | SK | 850 |
| 2 | 7½ | G.E. | RC | 850 |
| 1 | 7½ | West. | SK-60 | 850 |
| 2 | 7½ | G.E. | RF-9 | 600/1800 |
| 1 | 7½ | G.E. | RF-10A | 600/1500 |
| 1 | 7½ | West. | SK-90 | 650/1300 |
| 1 | 7½ | El. Dyn. | 3S | 550/1650 |
| 1 | 7½ | G.E. | RF-10 | 450/1800 |
| 1 | 7½ | G.E. | RF-10 | 450/1600 |
| 1 | 7½ | G.E. | RF | 450/1800 |
| 2 | 7½ | West. | SK-70 | 400/1600 |
| 1 | 7½ | Al. Ch. | | 350/1050 |
| 1 | 7½ | L-A | Baler | |

### 110 Volt D.C. Motors

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 45 | G.E. | RC | 1100 |
| 2 | 10 | Lincoln | I-SC | 3500 |
| 1 | 10 | L-A | | 3500 |
| 1 | 10 | E. Dyn. | 3S | 1100 |
| 1 | 10 | West. | SK-70 | 1150 |
| 1 | 10 | Reliance | | 400/1600 |
| 2 | 10 | Diehl | | 230 |
| 1 | 7½ | G.E. | CVC | 725 |
| 1 | 7½ | El. Dyn. | 5S | 450/900 |
| 1 | 7 | El. Dyn. | | 600/1200 |

### D.C. Generators

| KW | Make | Voltage | Ampere | Speed |
|---|---|---|---|---|
| 300 | Burke (2) | 250/125 | 1200 | 900 |
| 300 | West. (2) | 250 | 1200 | 900 |
| 250 | G.E. | 125 | 2000 | 720 |
| 150 | Ridgeway | 250 | 600 | 900 |
| 100 | Cr. Wh. | 250 | 400 | 570 |
| 100 | G.E. | 125 | 800 | 1150 |
| 50 | G.E. (2) | 125 | 400 | 1150 |
| 50 | G.E. | 250 | 200 | 870 |
| 30 | El. Dyn. | 600 | 50 | 1150 |
| 20 | G.E. | 125 | 240 | 1150 |
| 25 | G.E. | 125 | 200 | 1150 |
| 20 | West. | 250 | 100 | 1150 |
| 10 | West. | 250 | 40 | 1150 |
| 10 | West. | 125 | 80 | 1150 |
| 7½ | G.E. | 250 | 30 | 1150 |
| 7½ | West. | 125 | 60 | 1150 |

### AIR COMPRESSORS

**12½"x12" American**
**10"x6" Gardner**
**9"x8" Ingersoll Rand**
**9"x8" Sullivan**
**7"x6" Ingersoll Rand**

**11—150 H.P. Gen. Elec. and West. Latest Type Ball Bearing Squirrel Cage Motors. 3 ph. 60 cy. 220 or 440 volts 1765 RPM.**

**D.C. to A.C. Generators**
**1 to 10 K.V.A.**
**115 and 230 V.D.C. to 1 ph. and 3 ph. 110-220 & 440 V. A.C.**

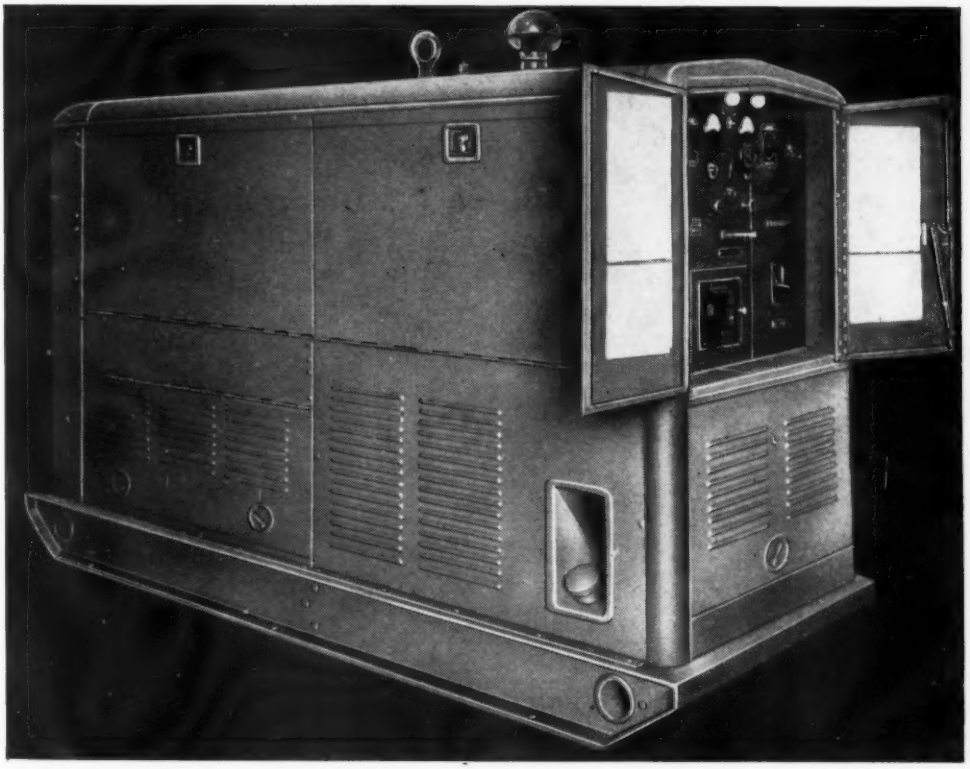
**THIS IS A PARTIAL LIST ONLY!**

# L. J. LAND & COMPANY

**148 GRAND STREET, NEW YORK 13, NEW YORK**

**Established 1910** **CAnal 6-6976**

# PORTABLE DIESEL GENERATOR SETS



15 KW 30 KW 50 KW

INTERNATIONAL UD-14–UD-18

BRAND NEW–SPOT DELIVERY

RADIATOR COOLED–SKID MOUNTED

60 cycle 127/220 volts
50 cycle 230/400 volts

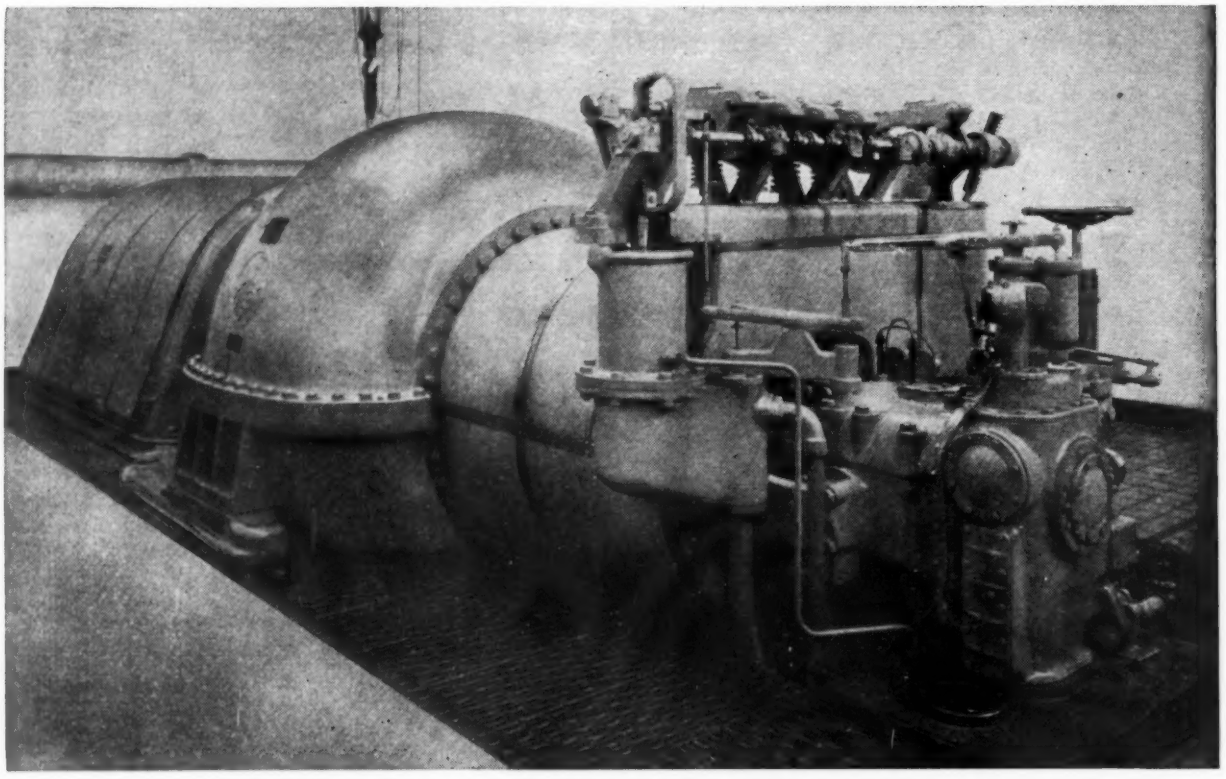
SPECIAL PURCHASE BARGAIN

**ROBERT SCHOONMAKER**

**Port Washington, Long Island, N. Y.**

**Phone Roslyn 1220**

# TURBINE GENERATOR UNITS AVAILABLE IMMEDIATE DELIVERY



**ACTUAL VIEW**

6000 KW P. F. General Electric, 13 stage, form EE, type R, 3600 RPM, 200-400 lbs. pressure direct connected to: 7500 KVA—6000 KW 80% P. F. General Electric, type ATB-2, form HT, 3 phase, 60 cycle, 2300/4000 volt, 3600 RPM alternating current generator equipped with a 9000 sq. ft., two-pass Elliott surface condenser with all condensing auxiliaries, 50 KW, 125 volt direct current steam turbine-exciter set, switchboard panels, instruments and oil circuit breaker—a complete installation. Installed new 1928.

4375 KVA G.E. condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 200# pressure, equipped with condenser and auxiliaries.

3125 KVA G.E. condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 225# pressure, 500° TT, equipped with either a surface or jet condenser, switchboard and instruments.

2500 KVA G.E. 6 stage condensing, 3 phase, 60 cycle, 2300 volts, 1800 RPM, 150-200# pressure, complete with motor driven exciter set, switchboard, C.H. Wheeler surface condenser and condensing auxiliaries.

1875 KVA G.E. condensing, 3 phase, 60 cycle, 6600 volts, 3600 RPM, 200#, 500° TT, complete with condenser.

1875 KVA Westinghouse condensing, 3 phase, 60 cycle, 480 volts, 3600 RPM, 175–200# pressure, 500° TT, complete with turbine driven exciter set, switchboard, Westinghouse jet condenser and condensing auxiliaries.

1500 KVA (2) General Electric, condensing, 200# pressure, 550 volts, 3600 RPM complete with condensers, exciters, switchboard panels and instruments.

1250 KVA Westinghouse condensing, 3 phase, 60 cycle, 2400 volts, 3600 RPM, 200# pressure, equipped with direct connected shaft exciter, condenser, switchboard and instruments.

1250 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 480 volts 3600 RPM, 200-250#, 500° TT, 15 lbs. gauge back pressure, complete with switchboard panel and instruments.

937 KVA, General Electric, condensing, 3 phase, 60 cycle, 2300 volt, 3600 RPM, 150# pressure equipped with condenser and auxiliaries.

780 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 480 volts, 3600 RPM, 175–200# pressure, 15 lbs. back pressure, complete.

625 KVA Westinghouse condensing, 3 phase, 60 cycle, 2400 volts, 3600 RPM, 200# pressure, equipped direct connected shaft exciter, condenser, switchboard and instruments.

375 KVA G.E. condensing, 3 phase, 60 cycle, 2300 volts, 360 RPM, 150–200# pressure, 100° SH, complete with surface condenser.

125 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 240 volts, 3600 RPM, 175–200# pressure, 0–10 lbs. guage back pressure with direct connected exciter and switchboard.

125 KVA G.E. non-condensing, 3 phase, 60 cycle, 240 volts, 3600 RPM, 125#, 10 lbs. gauge back complete with direct connected exciter.

125 KVA G.E. non-condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 150-200# pressure, 10 lbs. gauge back.

100 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 2400 volts, 3600 RPM, 125–200# pressure, 10 lbs. gauge back.

**Utilities Electrical Machinery Corporation**

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

# there is a full lifetime of service in— NEW MOTORS

## NEW STANDARD OPEN SQUIRREL CAGE 3/60/220-440 B.B. NEW

| Quan. | H.P. | Frame | R.P.M. | Quan. | H.P. | Frame | R.P.M. | Quan. | H.P. | Frame | R.P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1 | 204 | 1200 | 5 | 10 | 324 | 1800 | 5 | 50 | 504 | 1200 |
| 10 | 1 | 204 | 1800 | 5 | 10 | 326 | 1200 | 5 | 60 | 504 | 1800 |
| 17 | 1½ | 204 | 1800 | 10 | 15 | 326 | 1800 | 5 | 60 | 505 | 1200 |
| 14 | 1½ | 225 | 1200 | 12 | 15 | 365 | 1200 | 5 | 75 | 505 | 1800 |
| 3 | 2 | 224 | 1800 | 7 | 20 | 364 | 1800 | 5 | 75 | 5084 | 1200 |
| 9 | 2 | 225 | 1200 | 11 | 20 | 404 | 1200 | 2 | 100 | 5084 | 1800 |
| 8 | 3 | 223 | 1800 | 22 | 25 | 365 | 1800 | 2 | 100 | 5084 | 1200 |
| 6 | 3 | 254 | 1200 | 25 | 25 | 404 | 1200 | 2 | 125 | 5085 | 1800 |
| 15 | 5 | 254 | 1800 | 10 | 30 | 405 | 1800 | 2 | 125 | 6085 | 1200 |
| 5 | 5 | 284 | 1200 | 6 | 30 | 444 | 1200 | 2 | 150 | 5085 | 1800 |
| 7 | 7½ | 284 | 1800 | 5 | 40 | 444 | 1800 | 2 | 150 | 6085 | 1200 |
| 11 | 7½ | 324 | 1200 | 5 | 40 | 445 | 1200 | 2 | 200 | 6085 | 1800 |
| | | | | 3 | 50 | 445 | 1800 | 2 | 200 | 6085 | 1200 |

## NEW TOTALLY ENCLOSED FAN COOLED 3/60/220-440 B.B. NEW

| Quan. | H.P. | Frame | R.P.M. | Quan. | H.P. | Frame | R.P.M. | Quan. | H.P. | Frame | R.P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 1 | 203 | 1800 | 5 | 10 | 324 | 1800 | 5 | 50 | 445 | 1800 |
| 10 | 1 | 204 | 1200 | 5 | 10 | 326 | 1200 | 5 | 50 | 504 | 1200 |
| 30 | 1½ | 204 | 1800 | 7 | 15 | 326 | 1800 | 5 | 60 | 504 | 1800 |
| 13 | 1½ | 204 | 1200 | 5 | 15 | 365 | 1200 | 2 | 60 | 605 | 1200 |
| 7 | 2 | 224 | 1800 | 6 | 20 | 364 | 1800 | 3 | 75 | 505 | 1800 |
| 27 | 2 | 225 | 1200 | 8 | 20 | 404 | 1200 | 2 | 75 | 508 | 1200 |
| 21 | 3 | 225 | 1800 | 8 | 25 | 365 | 1800 | 2 | 100 | 508 | 1800 |
| 6 | 3 | 254 | 1200 | 7 | 25 | 405 | 1200 | 2 | 100 | 508 | 1200 |
| 5 | 5 | 254 | 1800 | 6 | 30 | 405 | 1800 | 2 | 125 | 6085 | 1800 |
| 6 | 5 | 284 | 1200 | 5 | 30 | 444 | 1200 | 2 | 125 | 6085 | 1200 |
| 5 | 7½ | 284 | 1800 | 5 | 40 | 444 | 1800 | 2 | 150 | 6085 | 1800 |
| 7 | 7½ | 324 | 1200 | 5 | 40 | 445 | 1200 | 2 | 150 | 6085 | 1200 |

## NEW D.C. MOTORS 230 VOLT NEW

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2— | ½ HP | Shunt | SL.B | DP | TL204 | 690/2760 | RPM | 20—2 | HP | Shunt | BB | DP | 225 | 1150 RPM |
| 3— | ½ HP | Shunt | BB | TE | T-224 | 690 | RPM | 13—2 | HP | Shunt | BB | DP | 224 | 1750 RPM |
| 21— | ¾ HP | Shunt | BB | DP | T-225 | 690 | RPM | 3—2 | HP | Shunt | SL | DP | 225 | 1150/2300 RPM |
| 4— | ¾ HP | Shunt | SL | DP | T-224 | 690/2760 | RPM | 5—3 | HP | Shunt | SL | DP | 225 | 1150/2300 RPM |
| 20—1 | HP | Shunt | BB | DP | T-204 | 1150 | RPM | 1—3 | HP | Shunt | BB | DP | 225 | 1750 RPM |
| 1—1 | HP | Shunt | SL | DP | 204 | 1150/2300 | RPM | 3—5 | HP | Shunt | BB | | 254 | 1750 RPM |
| 5—1½ | HP | Shunt | SL | DP | 224 | 1150/2300 | RPM | 1—5 | HP | Shunt | BB | Semi Enc. | 254 | 1750 RPM |
| 4—1½ | HP | Shunt | SL | DP | 224 | 1150/2300 | RPM | 1—7½ | HP | Shunt | BB | Open | 23-T | 1750 RPM |
| 20—1½ | HP | Shunt | BB | DP | 225 | 690/2760 | RPM | 1—10 | HP | Shunt | BB | DP | 34-T | 1750 RPM |
| 20—1½ | HP | Shunt | BB | DP | 204 | 1750 | RPM | 1—7½ | HP | Shunt | BB | DP | | 400/1600 RPM |

## NEW STOCK COMPENSATORS STOCK NEW

| | | | |
|---|---|---|---|
| 50 HP 220-60-3 | 125 HP 220-60-3 | 50 HP 440-60-3 | 125 HP 440-60-3 |
| 75 HP 220-60-3 | 100 HP 220-60-3 | 75 HP 440-60-3 | 150 HP 440-60-3 |
| 100 HP 220-60-3 | | 100 HP 440-60-3 | |

## NEW GEAR HEAD SPECIALS NEW

| | | |
|---|---|---|
| 1—30 HP GE JI.R. 129 RPM. Drum & Grids | 48—½ HP 350 RPM | 5—3 HP Exp. 550-60-3 159 RPM |
| 3—40 HP GE JI.R. 84 RPM. Drum & Grids | 13—½ HP 86.2 RPM | 5¼ HP Exp. 550-60-3 86 RPM |
| 22—10 HP @ 190 RPM | 5—5 HP Exp. 550-60-3 159 RPM | Many others send us your inquiries. |

## NEW A.C. MOTOR SPECIAL NEW

| | | |
|---|---|---|
| 8—200 HP Wagner RP2 440-60-3 1800 RPM | 11—30 HP A & C AR 440-60-3 900 RPM | 32—2 speed 1 HP @ 1800; 2 HP 3600 RPM New. |
| 6—50 HP TEFC 1200 RPM | 1—30 HP L. A. Splash Proof 3600 RPM | |
| 31—15 HP @ 1800 RPM; 7½ HP @ 900 RPM TEFC 2 speed | 1—25 HP L. A. Splash Proof 900 RPM | Other motors in stock. |
| | 4—40 HP @ CS Splash Proof 900 RPM | |

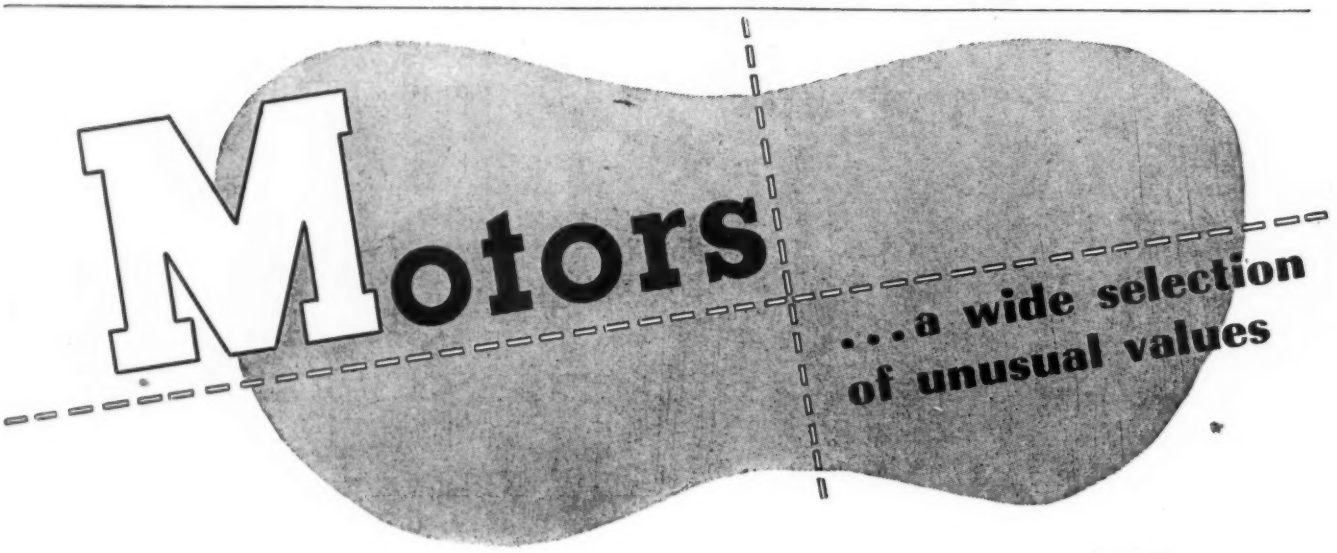
**THE ABOVE SUBJECT TO PRIOR SALE**

WRITE-WIRE-PHONE YOUR INQUIRIES TO

## Electric Motor & Machinery Co.

MONROE 1388-1389 P.O. BOX 1273 ROCHESTER 7, N. Y.

1132-38 MT. HOPE AVE.




# Listed below a few of the motors available in a hurry from Wente

## SQUIRREL CAGE

**3 Phase, 60 Cycle, 220/440 Volt**

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 150 | Al. Ch. | | 1750 |
| 1 | 100 | West. 2200v. | CCL | 1720 |
| 2 | 100 | G.E. | I | 580 |
| 1 | 100 | G.E. | I | 340 |
| 1 | 100 | G.E. | I | 290 |
| 1 | 75 | Lincoln | C10 | 1200 |
| 1 | 75 | G.E. | KT347 | 1160 |
| 2 | 75 | Lima | RS505 | 1200 |
| 1 | 75 | F.M. 550 v. | H165C | 900 |
| 1 | 75 | Lincoln | IQ | 600 |
| 1 | 75 | G.E. | KT562 | 450 |
| 8 | 75 | G.E. 2200 v. | I | 400 |
| 1 | 50 | Al. Ch. | TEFC | 900 |
| 1 | 50 | G.E. | I | 720 |
| 2 | 50 | West. | MS 25 cy. | 720 |
| 1 | 50 | Wag. | BM | 495 |
| 1 | 50 | Al. Ch. | | 490 |
| 1 | 40 | Wotton | | 1750 |
| 1 | 40 | West. | CS444 | 1760 |
| 4 | 40 | Louis A. | PS444 | 1160 |
| 2 | 40 | Lima | RS445 | 900 |
| 1 | 40 | Triumph | B12 | 850 |
| 2 | 35 | Al. Ch. | 2 ph. | 865 |
| 2 | 35 | Al. Ch. | | 865 |
| 1 | 35 | F. Wayne | 2 ph. | 900 |
| 1 | 35 | G.E. | 25 cy. | 730 |
| 1 | 30 | F.M. 2200 v. | HD12B | 3600 |
| 1 | 30 | Wagner | BP | 3600 |
| 1 | 30 | Howell | SC | 1200 |
| 1 | 30 | Al. Ch. | | 1200 |
| 1 | 30 | Louis A. | P405 | 1140 |
| 1 | 30 | Louis A. | KH | 1170 |
| 1 | 30 | American | TEBB | 1160 |
| 7 | 30 | G.E. | KT526 | 1200 |
| 1 | 30 | Al. Ch. | AR220C | 900 |
| 1 | 30 | West. | CCL | 900 |
| 1 | 30 | Wagner | 22VBR | 860 |
| 1 | 30 | Linc. Weld | ED445 TEFC | 850 |
| 1 | 30 | Al. Ch. | | 860 |
| 2 | 30 | Al. Ch. | AN 2 ph. | 860 |
| 1 | 30 | Century | AS 25 cy. | 720 |
| 1 | 25 | R. & M. | K207 | 1750 |
| 1 | 25 | G.E. | KT | 1750 |
| 1 | 25 | Howell | | 1200 |
| 3 | 25 | West. | CS405 | 1160 |
| 1 | 25 | G.E. | KF405 | 1160 |
| 1 | 25 | Lincoln | | 900 |
| 1 | 25 | G.E. | KT332 | 900 |
| 1 | 25 | Al. Ch. | | 860 |
| 1 | 25 | Rel. (elevator) | T. E. | 750 |
| 1 | 25 | Al. Ch. | | 720 |
| 1 | 25 | G.E. | M10 | 720 |
| 1 | 25 | West. | CS64'C | 690 |
| 3 | 25 | Lima | RS445 | 600 |
| 1 | 20 | West. | CCL | 3600 |
| 1 | 20 | Al. Ch. | | 1700 |
| 1 | 20 | Sterling | KFT364 | 1750 |
| 1 | 20 | Century | | 1740 |
| 1 | 20 | F. M. | KRV | 1200 |
| 1 | 20 | West. | | 1200 |
| 1 | 20 | Wagner | | 1150 |
| 1 | 20 | Ideal | A | 1150 |
| 2 | 20 | Wagner | HRP404 | 1060 |
| 1 | 20 | Cleve | M-147 | 900 |
| 1 | 20 | Al. Ch. | | 860 |
| 1 | 20 | R. & M. | K-207 | 900 |
| 1 | 20 | West. | CS-644 | 870 |
| 1 | 20 | West. | MS | 900 |
| 1 | 20 | F. M. | H | 870 |
| 1 | 20 | West. | CCL | 580 |
| 1 | 20 | Wagner | CM | 445 |
| 1 | 18 | West. | MS-4 (Elev.) | 720 |
| 1 | 15 | West. | CCL | 1700 |
| 1 | 15 | Wagner | 13VRW | 1725 |
| 1 | 15 | Rel. | B326 | 1750 |
| 1 | 15 | Wagner | 13VRW 2 ph. | 1725 |
| 1 | 15 | Cr. Wh. | 1150 | 1720 |
| 1 | 15 | West. | CS-460C | 1200 |
| 2 | 15 | Diehl | IN-365 | 1150 |
| 1 | 15 | Wagner | 15TCP-TEFC | 1140 |
| 1 | 15 | G.E. | KT512 | 875 |
| 2 | 15 | West. | CS-573 25 cy. | 725 |
| 2 | 15 | West. | MS 25 cy. | 725 |
| 1 | 15 | West. | CS567C 25 cy. | 715 |
| 1 | 15 | West. | MS 25 cy. | 600 |
| 1 | 15 | Louis A. | OMS445 1750/1150/870/575 | |
| 1 | 10 | Al. Ch. | | 3450 |
| 1 | 10 | G.E. | KT302 | 900 |
| 1 | 10 | West. | CS 25 cy. | 725 |
| 1 | 10 | West. | MS 25 cy. | 720 |
| 2 | 10 | West. | CS473C 25 cy. | 615 |
| 1 | 7½ | Al. Ch. | | 860 |
| 1 | 7½ | Wagner | MCP-365 | 1140 |
| 1 | 7½ | Lima | RS-405 b. b. | 514 |

## SLIP RING

**3 Phase, 60 Cycle, & Syn.**

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 443 | El. Mach. | | 900 Syn. |
| 1 | 300 | G.E. | MT412 | 352 |
| 1 | 275 | Al. Ch. | | 1170 |
| 1 | 200 | F. M. | BV | 600 |
| 1 | 200 | Al. Ch. | | 1175 |
| 1 | 200 | Westg. 2200 v. | | 600 Syn. |
| 1 | 150 | Westg. | | 580 |
| 2 | 75 | F. M. 2200 v. | BV-H16B | 1800 |
| 1 | 75 | G.E. | MT552 | 865 |
| 1 | 65 | Al. Ch. Alt. | | 1200 |
| 1 | 60 | Lincoln | IXM | 900 |
| 1 | 60 | G.E. | MT556 | 600 |
| 1 | 50 | G.E. | IM | 1150 |
| 1 | 50 | Triumph | C12 | 1150 |
| 1 | 50 | G.E. | IM | 900 |
| 1 | 50 | G.E. | IM 25 cy. | 700 |
| 1 | 50 | Al. Ch. | | 690 |
| 1 | 50 | Ideal | | |
| 2 | 40 | G.E. | MT336 | 1200 |
| 1 | 40 | Al. Ch. | | 1160 |
| 1 | 40 | W'g. 2200 v. | CW | 870 |
| 1 | 40 | Westg. | CW-658A | 870 |
| 2 | 40 | Al. Ch. | | 870 |
| 1 | 40 | G.E. | MY-W | 880 |
| 1 | 40 | Westg. | C1753A 25 cy. cr. | 730 |
| 10 | 35/15 | G.E. | OMT336 | 1150/550 |
| 1 | 35 | Al. Ch. | 25 cy. | 720 |
| 2 | 35 | G.E. | IM | 570 |
| 1 | 30 | F. M. | AD Alt. | 1200 |
| 1 | 20 | Imperial | DW-D37 | 1800 Syn. |
| 1 | 22 | G.E. | ITC5011 (hoist) | 680 |
| 1 | 25 | Westg. | MW 322A | 680 |
| 1 | 25 | G.E. | MT342 | 600 |
| 1 | 25 | G.E. | MT356 | 400 |
| 1 | 20 | Triumph | C10 | 1200 |
| 2 | 15 | G.E. | MT302 | 1200 |
| 1 | 15 | G.E. | MT332 | 720 |
| 1 | 15 | Triumph | C11 | 685 |
| 1 | 15 | Westg. | C8 | 585 |
| 1 | 15 | G.E. | MT556 | 280 |
| 1 | 10 | Westg. | CW364 (Ex. proof) | 1750 |
| 3 | 10 | Westg. | CW464A | 1200 |
| 1 | 10 | Westg. | HF | 1140 |
| 1 | 10 | W. E. | | 1200 |
| 1 | 10 | G.E. | IM | 1200 |
| 1 | 7½ | G.E. | MT182 | 1750 |
| 1 | 7½ | Westg. | CW-452A | 1200 |

## DC—230 Volt

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 2 | 175 | Westg. | SK | 150/550 |
| 1 | 100 | Westg. | SK180 | 600 |
| 1 | 75 | Diehl | K11 | 700 |
| 1 | 100 | G.E. | CD 123 | 1200 |
| 1 | 60 | Westg. 115v. | SK140L Bert. | 1140 |
| 1 | 60 | G.E. | EF1 | 1200 |
| 1 | 40 | Rel. 440 v. | 13LT Vert. | 1750 |
| 1 | 40 | Rel. 440 v. | 230T Vert. | 1130 |
| 1 | 25 | C.W. 440 v. | CMC-EH Vert. | 1150 |
| 2 | 40 | Westg. | SK 123 | 1150 |
| 3 | 40 | G.E. | RC 32 | 1100 |
| 8 | 40 | Westg. | SK 140 | 775 |
| 1 | 35 | R. C. | 11B | 1500 |
| 1 | 35 | Al. Ch. | | 1200 |
| 1 | 35 | G.E. | DLC 203 | 700 |
| 1 | 35 | Westg. | SK 163 Vert. | 300/1200 |
| 1 | 30 | El. Dy. | 15S | 625 |
| 1 | 30 | Westg. | SK 110L | 1150 |
| 1 | 30 | Rel. 440 v. | 131 T Vert. | 1150 |
| 4 | 30 | Reliance | 92 TF | 1750 |
| 1 | 27½ | G.E. | CVC 116 | 1750 |
| 10 | 25 | Westg. | SK 120 | 825 |
| 3 | 25 | Westg. | SK 103 | 1150 |
| 1 | 25 | Westg. | SK 90 | 1400 |
| 4 | 25 | Westg. | SK 100 L | 1150 |
| 1 | 30 | G.E. | RC 51B | 1150 |
| 1 | 25 | Sprague | | 850/2000 |
| 1 | 25 | Westg. | SK 123 | 550/1100 |
| 1 | 25 | Al. Ch. | E 120 | 500/1500 |
| 1 | 25 | G.E. | RF 12 | 400/1200 |
| 2 | 25 | Westg. | SK | 400/1200 |
| 1 | 25 | J. & L. | | 625 |
| 2 | 20 | Reliance | 131T | 1000 |
| 2 | 20 | Diehl | K914A | 500/1500 |
| 2 | 20 | Westg. | SK113 | 500/1500 |
| 1 | 20 | G.E. | RF12 | 250/1000 |
| 1 | 20 | Lincoln | FKW B.B. | 1800 |
| 1 | 20 | Westg. | SK70L | 1700 |
| 6 | 20 | Cr. Wh. | CMC T.E.B.B. | 1750 |
| 1 | 20 | Cr. Wh. | CMC T.E.B.B. | 1150 |
| 1 | 20 | Westg. | SK93 | 1150 |
| 1a | 20 | Reliance | 92T | 1150 |
| 1 | 20 | Westg. | SK120 T.E. | 1100 |
| 3 | 20 | Westg. | SK100L | 900 |
| 1 | 20 | Watson | K | 850 |
| 3 | 20 | Reliance | 131T | 850 |
| 1 | 20 | G.E. | RC30 | 750 |
| 1 | 20 | Westg. | SK110L-115V | 750 |

## DC—230 Volt

| Qu. | HP | Make | Type | R.P.M. |
|---|---|---|---|---|
| 4 | 20 | Westg. | SK110L | 750 |
| 1 | 20 | Cr. Wh. | CW-CMC | 600 |
| 1 | 20 | Westg. | SK120 | 500 |
| 3 | 20 | Al. Ch. | K | 500/1000 |
| 1 | 15 | Reliance | 46TF | 1750 |
| 2 | 15 | Westg. | SK63 | 1750 |
| 1 | 15 | Westg. | SK113 encl. | 1750 |
| 1 | 15 | G.E. | RC29A | 1700 |
| 1 | 15 | Westg. | SK93 | 1150 |
| 4 | 15 | Westg. | SK83 | 1150 |
| 4 | 15 | Cr. Wh. | CW-CCM T.E. | 1150 |
| 1 | 15 | Westg. | SK70L | 1250 |
| 1 | 15 | G.E. | CD83 | 1150 |
| 1 | 15 | G.E. | RC10 | 1150 |
| 1 | 15 | G.E. | RC29 | 1150 |
| 4 | 15 | Westg. | SK93 | 850 |
| 4 | 15 | Reliance | 92TF | 850 |
| 4 | 15 | R. & M. | | 1000 |
| 1 | 15 | G.E. | CVC-115 | 925 |
| 6 | 15 | Westg. | SK90 Vert. | 825 |
| 1 | 15 | G.E. | RC29 | 750 |
| 6 | 15 | Westg. | SK110L | 675 |
| 1 | 15 | Al. Ch. | | 1075 |
| 8 | 15 | Reliance | 131T | 550 |
| 3 | 15 | Reliance | 92T | 850/1700 |
| 1 | 15 | Reliance | 66T | 800/1600 |
| 1 | 15 | Westg. | SK | 500/1500 |
| 2 | 15 | Westg. | SK110L | 400/1600 |
| 1 | 15 | Triumph | 32F | 300/600 |
| 1 | 15 | Triumph | | 225/900 |
| 1 | 12½ | Westg. | SK | 750/1500 |
| 7 | 10 | Westg. | SK70 | 850 |
| 2 | 10 | Reliance | 66TF | 850 |
| 2 | 10 | G.E. | RC29 | 850 |
| 20 | 10 | Westg. | SK60L-SK60-Reliance 46TF | 1150 |
| 10 | 10 | Cr. Wh. | CM-CHB T.E.B.B. | 1750 |
| 4 | 10 | Westg. | SK43 | 1700 |
| 1 | 10 | G.E. | RF11 | 600/2400 |
| 4 | 10 | G.E. | RF10 | 600/1800 |
| 6 | 10 | Westg. | SK80L | 500/1500 |

## DC—230 Volt

| Qu. | HP | Make | Type | R.P.M. |
|---|---|---|---|---|
| 23 | 10 | Al. Ch. | | 500/1000 |
| 1 | 10 | G.E. | RF10 | 400/1200 |
| 2 | 10 | Kimble | BA324 new B.B. | 1750 |
| 1 | 10 | Westg. | SK91 | 250/1000 |
| 21 | 7½ | Westg. | SK33 | 1750 |
| 16 | 7½ | Westg. | SK43 | 1150 |
| 20 | 7½ | Westg. | SK60 | 850 |
| 20 | 5 | Westg. & G.E. | | 1750 |
| 60 | 5 | Westg. Rel. | | 1150 |
| 50 | 5 | Westg. | SK43 | 850 |
| 75 | 3½ | Westg. | SK33 | 850 |
| 80 | 3 | Westg. | CD925 | 1725 |
| 120 | 3 | Westg. | SK20 | 1150 |
| 60 | 2 | Westg. | SK & CD | 1150 |
| 50 | 2 | Westg. | SK20 | 850 |
| 40 | 1½ | Westg. | CD | 1150 |
| 30 | 1½ | Westg. | CD925 | 550/2200 |

# The Wente Electric Co.

Hamilton, Ohio

**Rebuilt Motors & Generators**

*Since 1906*

# REBUILT POWER EQUIPMENT

**READY TO SHIP!**

## SLIPRING MOTORS—3 PH., 60 Cy.

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 700 | G.E. | 2200 | 393 | MT-432 |
| 350 | West | 2200 | 900 | CW |
| 260 | Burke | 440 | 600 | EMY-65 |
| 200 | G.E. | 220/440 | 1200 | M-1 |
| 150 | G.E. | 220/440 | 1200 | M-1 |
| 75 | G.E. | 220/440 | 1200 | I |
| 60 | West. | 220/440 | 1800 | CW |
| 50 | Chandeys'n | 220/440 | 1800 | |
| 50 | West. | 220/440 | 1120 | HF |
| 20 | Westg. | 220 | 575 | CW |
| 15 | G.E. | 220/440 | 850 | I |
| 10 | G.E. | 220 | 1200 | MTC-5201 |
| 7½ | G.E. | 220 | 1200 | MTC-5201 |

## ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 150 | Wagner | 440 | 1800 | 31V |
| 125 | West. | 220/440 | 1800 | CS |
| 125 | West. | 220/440/2300 | 1200 | |
| 100 | Triumph | 220/440 | 850 | B-15 |
| 75 | West. | 220/440 | 1800 | MS |
| 75 | Triumph | 220/440 | 685 | B-15 |
| 75 | West. | 220 | 685 | CCL |
| 75 | G.E. | 440 | 695/720 | I |
| 60 | West. | 220/440 | 1800 | CS |
| 60 | West. | 220/440 | 1800 | CS-T.E. |
| 60 | Allis Chal. | 220/440 | 1760 | |
| 50 32 | G.E. | 440 | 800/640 | |
| 50 | Chandeys'n | 220/440 | 1800 | |
| 50 | West. | 220 | 1200 | CD |
| 50 | G.E. | 440 | 695/720 | I |
| 40 | West. | 220/440 | 1800 | CS |
| 30 | Al. Chal. | 220 | 870 | |
| 20 to 25 | G.E. | 220 | 900 | I |
| 25 | G.E. | 220/440 | 1800 | K |

## VARIABLE SPEED MOTORS— 230 VOLT D.C.

| H.P. | Make | R.P.M. | Type |
|---|---|---|---|
| 100 | West. | 300/900 | SK-191 |
| 75 | West. | 400/650 | SK-181 |
| 30 | G.E. | 450/900 | RIC |
| 20 | West. | 500/1500 | SA |
| 20 | West. | 750/1500 | SK-110L |
| 20 | West. | 625/1250 | SA-6 |
| 20 | Westg. | 750/1500 | SK-110L |
| 15 | Reliance | 500/1800 | |
| 15 | West. | 875/1600 | SA |
| 13 | West. | 500/1000 | S-7 |
| 10 | West. | 400/1600 | SA-7 |
| 10 | G.E. | 625/1250 | LC |
| 10 | Westg. | 565/1130 | S-6 |
| 7½ | West. | 450/1800 | SK |
| 5 | West. | 400/800 | SK-80 |
| 4 | G.E. | 850/1700 | LC-8 |
| 3 | G.E. | 400/1200 | RLC-114 |
| 3 | Roth | 500/1000 | RS |

## SERIES WOUND MOTORS

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 175 | G.E. | 230 | 475 | MD |
| 140 | G.E. | 230 | 410 | MD |
| 80 | G.E. | 230 | 500 | MD-107 |
| 80 | West. | 230 | 490 | 76-A |
| 68 | G.E. | 220 | 475 | CO-2007 |
| 50 | G.E. | 230 | 550 | MD-106 |
| 50 | Cr. Wh. | 230 | 500 | SM |
| 35 | Westg. | 230 | 550 | 49D |
| 32 | G.E. | 230 | 450 | 801 |
| 32 | Shaw | 230 | 485 | 5L2E |
| 28 | Westg. | 230 | 395 | 904 |
| 25 | West. | 230 | 600 | MT |
| 15 | West. | 230 | 800 | HD |
| 15 | Cr. Wh. | 220 | 270 | SM |
| 10 | West. | 230 | 650 | MT-00 |
| 7½ | G.E. | 230 | 725 | CO-1804 |

## 230 VOLT DC MOTORS

| H.P. | Make | R.P.M. | Type |
|---|---|---|---|
| 100 | West. | 300 | SK |
| 85 | West. | 500 | M |
| 80 | G.E. | 500 | MD107 |
| 80 | G.E. | 600 | DLC-206 |
| 75 | G.E. | 600 | MP |
| 75 | G.E. | 1500 | DT-1121 |

## TRANSFORMERS 1 ph. 60 Cy.

| No. | Kva. | Pri. | Sec. | Make |
|---|---|---|---|---|
| 3 | 250 | 2300 | 460/230 | Allis Chal. |
| 3 | 250 | 6600/5940 | 2300 | West. |
| 2 | 150 | 2200/2300/2400 | 220/230/240 | G.E. |
| 3 | 125 | 2200 | 220/440 | G.E. |
| 3 | 112 5 | 2400 | 240/480 | G.E. |
| 3 | 100 | 2400 | 240/480 | Allis Chal. |
| 3 | 5 | 2300 | 220/410 | G.E. |
| 3 | 75 | 2400–4160Y | 240/480 | Allis Chal. |
| 1 | 75 | 2400–4160Y | 120/240 | West. |
| 4 | 75 | 2400 | 240/480 | G.E. |
| 3 | 75 | 2400–4000Y | 120/240 | Allis Chal. |
| 1 | 75 | 2400 | 240/480 | G.E. |
| 2 | 50 | 2200/1100 | 220/110 | Maloney |
| 2 | 50 | 2200 | 110/220 | Packard |
| 1 | 40 | 2300/1150 | 113/230 | Maloney |
| 1 | 40 | 1100/2200 | 110/220 | Pittsburgh |
| 3 | 40 | 2300/1100 | 220/110 | West. |
| 9 | 37½ | 2400 | 480/240 | G.E. |
| 1 | 25 | 2300 | 110/220 | West. |
| 2 | 20 | 2300/110 | 440/220/110 | West. |
| 1 | 20 | 2300 | 110/230 | West. |
| 2 | 20 | 1150/2300 | 115/230 | Maloney |
| 6 | 18 | 220 | 19½/38½ | El. Furnace |
| 3 | 15 | 2200 | 110/220 | Cr. Wh. |
| 3 | 15 | 2200 | 110/220 | Packard |
| 21 | 15 | 2200/1100 | 440/220/110 | West. |
| 58 | 7½ | 2200 | 116/220 | G.E. & West. |
| 9 | 5 | 2200 | 110/220 | G.E. & West. |

## D.C. CLARK CONTROLLER

1—250 HP Clark Vari Time magneto controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

## MOTOR GENERATOR SETS— 250 V. D.C.

1—75 KW 250 v. West. Gen. dir. con. 440 v. 3 ph. 60 cy. AC Motor
1—65 KW 1800 rpm. 250 v. G. E. Gen. dir. con. 220/440 v. 3 ph. 60 cy. AC Motor
1—50 KW 250 v. DC Gen. dir. con. 220/440 v. 3 ph. 60 cy. AC Motor
1—40 KW West. 250 v. DC Gen. dir. con. 220/440 v. 3 ph. 60 cy. AC Motor
1—30 KW 250 v. DC cp.wd. Gen. dir. con. 220/440 v. 3 ph. 60 cy. AC Motor
2—25 KW 250 v. DC West. Gens. dir. con. 220/440 v. 3 ph. 60 cy. Motors

## INDUSTRIAL TRUCKS

10—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.

***WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST, LIST YOUR IDLE EQUIPMENT WITH US***

## Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

# MOTORS • GENERATORS • TRANSFORMERS

## MOTORS 3 phase, 25 cycle, 220/440 Volts

| HP | Make | Type | Frame | RPM |
|---|---|---|---|---|
| 1 | Gen. Elect. | K | 224 | 1450 |
| 1 | Westinghouse | CS | 224 | 1425 |
| 1 | Robbins-Myers | H | Ball Bearing | 1425 |
| 1 | Gen. Elect. | KT | 926 | 1345 |
| 1½ | Louis Allis | ES | Ball Bearing | 1430 |
| 2 | Gen. Elect | KT | 731 | 750 |
| 2 | Brown & Brockmyer | | Enclosed | 1450 |
| 2 | Gen. Elect. | KT | 934 | 1450 |
| 2 | Gen. Elect. | KT | 140 | 1450 |
| 2(3) | Reliance | Enclosed | Ball Bearing | 750 |
| 2(5) | Westinghouse | T.E.F.C.B.B. | 284 | 500 |
| 2(3) | Reliance | Ball Bearing | 15AA | 750 |
| 3 | Westinghouse | CS | 284 | 750 |
| 3 | Allis Chalmers | | | 710 |
| 3 | Gen. Elect. | KT | 180 | 710 |
| 3 | Westinghouse | CS | 354A | 715 |
| 3 | Wagner | LBP | | 1420 |
| 3(5) | Gen. Elect. | KT | 944 | 1500 |
| 3(2) | Cr. Wheeler | T.E.F.C.B.B. | 284 | 750 |
| 3 | Cr. Wheeler | SC | | 1500 |
| 3 | Reliance | Ball Bearing | | 750 |
| 5 | Gen. Elect. | KT | 180 | 1500 |
| 5 | Gen. Elect. | K | 284 | 1450 |
| 5 | Gen. Elect. | KT | 181 | 750 |
| 5 | Reliance | Ball Bearing | 44AA | 750 |
| 7½ | Lincoln | B. B. | D111 | 1500 |
| 7½ | Howell | B. B. R. | 326 | 1500 |
| 7½ | Gen. Elect. | KF | | 1450 |
| 7½(2) | Gen. Elect. | KT | 181 | 1450 |
| 7½ | Century | ARS | | 1450 |
| 7½ | Wagner | | | 750 |
| 10(7) | Wagner | 19TBM | | 710 |
| 10 | Westinghouse | CS | | 710 |
| 10 | Reliance | | | 750 |
| 10(2) | Gen. Elect. | KT | 312 | 750 |
| 10(5) | Gen. Elect. | KT | 512 | 750 |
| 10(3) | Westinghouse | Enclosed | Gear Head | 1500/378 |
| 15 | Gen. Elect | KT | 327 | 750 |
| 15 | Westinghouse | MS | | 750 |
| 15(3) | Westinghouse | CCL | | 750 |
| 15 | Westinghouse | CCL | | 1500 |
| 15 | Master | Enclosed | Gear Head | 1500/416 |
| 20 | Westinghouse | CS | | 730 |
| 20(3) | Westinghouse | CCL | | 750 |
| 20 | Wagner | BP22T | | 750 |
| 25 | Gen. Elect. | I | Form K | 750 |
| 30 | Burke | | | 750 |
| 30 | Gen. Elect. | I | Form K | 750 |
| 30 | Wagner | | | 750 |
| 40 | Wagner | 22TLBP | | 1500 |
| 40 | Gen. Elect. | KT | 347 | 750 |
| 50 | Gen. Elect. | I | Form K | 750 |
| 75(4) | Gen. Elect. | I | Form K | 500 |
| 75(2) | Gen. Elect. | KT | 557 | 750 |
| 75 | Westinghouse | CS | | 750 |
| 100 | Westinghouse | CCL | | 500 |
| 150 | Gen. Elect. | I | Form K | 375 |
| 150 | Gen. Elect. | KT | 568 | 375 |
| 150 | Gen. Elect. | KT | 557Y (2200 v.) | 1470 |
| 200 | Gen. Elect. | I | Form K | 500 |
| 225 | Elect. Mach. | Synch. | (2200 v.) | 500 |

## TRANSFORMERS

3— 75 KVA Niagara. New. OISC 60/1/2400/120/240.
6—100 KVA Niagara. New. OISC 60/1/2400/120/240.
3—150 KVA Westinghouse OISC 25/1/2300/460.
3—200 KVA Westingnouse OISC 25/1/2300/460.
3—500 KVA Pittsburgh OISC 25/1/2300/230/460.

## MOTORS 3 phase, 60 cycle, 220/440 Volts

| HP | Make | Type | RPM | Serial No. |
|---|---|---|---|---|
| 15 | Westinghouse | CS | 1200 | 1883285 |
| 15 | Westinghouse | MS | 1200 | 9445931 |
| 20 | Westinghouse | CS | 1200 | 2160500 |
| 20 | Westinghouse | MS | 1200 | 1050826 |
| 20 | Westinghouse | CS | 1800 | 1863526 |
| 20 | Westinghouse | CS | 1800 | 2695044 |
| 25 | Westinghouse | MS | 1800 | 1562026 |
| 25 | Westinghouse | MS | 1800 | 1334763 |
| 25 | Westinghouse | CS | 1200 | 2286768 |
| 25 | Westinghouse | MS | 1200 | 1197673 |
| 25 | Wagner | BP | 1200 | 126906 |
| 30 | Westinghouse | MS | 1200 | 1197674 |
| 30 | Fairbanks-Morse | V-H-10D | 1800 | 43476 |
| 40 | Westinghouse | CS | 900 | 1896969 |
| 40 | General Electric | I-K | 1800 | 73318 |
| 40 | Westinghouse | MS | 1800 | 1506800 |
| 40 | General Electric | I-K | 1200 | 181444 |
| 40 | Westinghouse | MS | 1200 | 1027421 |
| 50 | Westinghouse | MS | 1800 | 1289389 |
| 50 | Westinghouse | MS | 1200 | 854410 |
| 50 | Westinghouse | CS | 1800 | 2691183 |
| 50 | General Electric | 14 | 1800 | 181444 |
| 50 | General Electric | KT-352 | 720 | |
| 50 | Allis Chalmers | | 1800 | 3K28825 |
| 60 | Reliance | | 1200 | B11458 |
| 60 | General Electric | I | 1800 | 292596 |
| 60 | Westinghouse | CCL | 1800 | 329654 |
| 60 | Robbins-Myers | K | 1800 | P515362 |
| 60 | Triumph | | 1800 | C14248 |
| 60 | Westinghouse | CCL | 1200 | 854121 (2200 v.) |
| 100 | Westinghouse | CCL | 1800 | 1043213 |
| 100 | Westinghouse | CCL | 1800 | 765231 (2200 v.) |
| 125 | Westinghouse | CS | 1200 | 2318625 |
| 150 | Westinghouse | CS | 1800 | 2429726 |
| 150 | Westinghouse | CCL | 900 | 438385 |
| 150 | Westinghouse | CS | 1200 | 4572586 (2200 v.) |
| 150 | General Electric | I-K | 1200 | |
| 150 | Westinghouse | CCL | 720 | 808349 (2200 v.) |
| 200 | General Electric | I-K | 900 | 232917 (2200 v.) |
| 200 | Westinghouse | CCL | 900 | 919537 (2200 v.) |
| 250 | General Electric | I-K | 600 | 2246834 |
| 300 | General Electric | I-K | 720 | 2357743 |
| 400 | General Electric | I-K | 900 | 2347845 |

## SLIP RING MOTORS 3 phase, 60 cycle, 220/440 Volts

| HP | Make | Type | RPM | Serial No. |
|---|---|---|---|---|
| 20 | Westinghouse | CW644C | 675 | 8009992 |
| 20 | General Electric | MT332 | 545 | 3889010 |
| 30 | Westinghouse | HF | 1745 | 4558408 |
| 40 | Westinghouse | CW748 | 690 | 4406823 |
| 250 | Allis Chalmers | 3 bearing | 505 | 104390 (2300 v.) |
| 400 | General Electric | I-M | 900 | 224674 |
| 400 | General Electric | I-M | 900 | 246762 |

## MAGNETIC CONTACTOR

400 HP. Gen. Elec. Type CR 7006. Form D12D. 3/60/440 Volts.

## 25 CYCLE GEARHEAD MOTORS

3—10 HP. Westinghouse Frame. 364. Enclosed 1500/378 RPM.
15 HP. Master Frame 405 Enclosed 1400/416 RPM.

## WELDERS

1—300 AMP. Lincoln Shield Arc—60 cycle.
1—400 AMP. Lincoln Shield Arc—25 cycle.

## SPECIAL

5—5 HP. Westinghouse Motors Nema Frame CSW. 284—Totally Enc., Fan Cooled Ball Bearing 3/60/220/440 volts, 1200 RPM.

## FREQUENCY CHANGER

450 KVA. Westinghouse Synch. Generator, 25 cycle, 3 phase, 440 volts, 720 RPM., direct connected to 850 HP. West. Synch. Motor 60 cycle, 3 phase, 4160 volts, 720 RPM. With starting equipment and panels.

## ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

# THE PICK OF POWER EQUIPMENT

### TURBINE UNITS—60 Cy.

1—22500 KW General Electric Cond.
1—15300 KVA Westinghouse Cond.
1— 7500 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 3750 KVA Westinghouse Extrac.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA General Electric Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Extrac.
1— 625 KVA General Electric Cond.
2— 625 KVA General Electric Non-C.

### D. C. TURBO UNITS

1—125 KW General Electric, 125 V.
1— 75 KW General Electric, 125 V.
1— 50 KW Westinghouse, 125 V.

### STEAM ENGINE UNITS—60 Cy.

1—625 KVA Ames Uniflow
2—480 KVA Skinner Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—300 KVA Skinner Uniflow
1—150 KVA Ames Uniflow

### D. C. STEAM ENGINE UNITS

1—500 KW Ames Uniflow 125 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire

### DIESEL ENGINE UNITS

1—1400 HP Fair.-Morse, 2300 V. 60 cy. gen.
3— 700 HP Enterprise, 2400 V. 60 cy. gen.
1— 625 HP Worthington, 240 V. 60 cy. gen.
2— 450 HP Worthington, 2300 V. 60 cy. gen.
1— 440 Nordberg, 250 V. DC gen.
2— 400 HP LeRoi RX1SV (gasoline) eng. only
1— 375 HP McInt. & Sey., 240 V. 60 cy. gen.
1— 300 HP McInt. & Sey., 480 V. 60 cy. gen.
1— 150 HP Buckeye 400 RPM engine only
2— 125 HP Winton, 240 V. 60 cy. gen.

### WATER TUBE BOILERS

4—1373 HP B. & W. 230-lb., Oil Fired
1—1302 HP Springfield 400-lb., Pulverizer
2— 760 HP Stirling 250-lb., Stokers
2— 617 HP Wickes 250-lb., Bent Tube
1— 607 HP Wickes 250-lb., Stoker
6— 600 HP B. & W. 200-lb., Stokers
2— 600 HP Springfield 200-lb., Stokers
2— 560 HP Erie City 460-lb.
2— 481 HP Springfield 225-lb., Pulverizer
2— 405 HP Erie City 160-lb., Stokers

### SYNCHRONOUS MOTORS

1—600 HP G. E. 60 cy. 2200 V. 600 RPM
1—500 HP Al. Ch. 60 cy. 2300 V. 450 RPM
1—375 HP G.E. 60 cy. 2300 V. 1800 RPM
2—250 HP G. E. 60 cy. 2200 V. 225 RPM
1—200 HP Ideal 60 cy. 4000 V. 514 RPM
1—100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

### INDUCTION MOTORS—60 Cy.

1—1000 HP West. slip ring 2200 V. 360 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
1— 200 HP Burke sq. cage 440 V. 575 RPM
2— 100 HP G. E. sq. cage 440 V. 720 RPM
2— 100 HP West. sq. cage 220/440 V. 1800 RPM

### MOTOR GEN. SETS—60 Cy.

1—1000 KW General Electric 600 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 150 KW General Electric 125 V. DC
1— 100 KW Westinghouse 125 V. DC
1— 100 KW Burke 250 V. DC
1— 75 KW General Electric 125 V. DC

### ROTARIES—60 Cy.

2—2600 KW General Electric 300 V.
1—2000 KW General Electric 600 V.
2—1750 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
1— 500 KW General Electric 250 V.

### FREQUENCY CHANGERS

2—12500 KW G. E. 60/25 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
1— 1500 KW West. 25/60 cy. 300 RPM
1— 1000 KVA Al. Ch. 25/62½ cy. 375 RPM

### TRANSFORMERS—1 Ph. 60 Cy.

4— 6667 KVA G. E. 79660/138,000-34500 V.
3— 3333 KVA Moloney 66000/33000-13200 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000-33000 V.
3— 100 KVA G. E. 66000-6900/11000 V.
3— 1000 KVA G. E. 44000/22000-480 V.
1— 7500 KVA West. 33000-13800 V. 3 ph.
3— 200 KVA G. E. 33000-2300/4000Y V.
3— 150 KVA G. E. 33000-2300 V.
40— 50 KVA G.E. 33000-2400 V. New
50— 25 KVA G.E. 33000-2400 V. New
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 200 KVA G.E. 22000-230/460 V.
1—10000 KVA West. 13200-4560 V. 3 ph.
1— 3000 KVA G. E. 13200-480 V. 3 ph.
3— 1667 KVA Pitts. 13200-2300 V.
4— 1250 KVA Pitts. 13500-230/460 V.
3— 200 KVA G.E. 13200-480 V. Pyranol
3— 100 KVA West. 13200-2300 V.
1— 2000 KVA G. E. 6600-2300, 3-P. Master Sub.
3— 150 KVA G. E. 4150-220 V. 3 ph.
2— 1500 KVA Al. Ch. 2400-480 V. 3 ph.
3— 333 KVA G.E. 2400/4150-230/460 V.
3— 250 KVA Al. Ch. 2300-230/460 V.

### OIL CIRCUIT BREAKERS

| | | |
|---|---|---|
| 2—1000 A. 30 KV Kelman CB76 | Outdoor |
| 1— 400 A. 25 KV G. E. FKO136 | " |
| 2— 600 A. 15 KV G. E. FKO37 | " |
| 1— 600 A. 15 KV West. O-221 | " |
| 2— 400 A. 15 KV G. E. FHKO136 | " |
| 3— 400 A. 7.5 KV G. E. FKO227 | " |
| 2—1200 A. 7.5 KV G. E. FKI32B | " |

*PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT*

## BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

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## SYNCH. CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

## MOTOR GENERATORS

300 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM
300 KW WEST. SYN. 250 V. 4000/6600 A.C. 900 RPM
150 KW WEST. SYN. 600 V. 2300/4000 AC. 1200 RPM

**Each unit listed above is owned by us and is available now for immediate purchase**

## WALLACE E. KIRK CO.

**Incorporated**

**502 Grant Building, Pittsburgh, Pa.**

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## TRANSFORMERS

**New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.**

**ATLANTIC TRANSFORMER CO.**
*Transformer Specialists*
**5143 N. 2nd St. Phila., Pa.**

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## POWER PLANT EQUIPMENT

*Special Offerings*

### TURBO-GENERATORS

1—3000 KW. 2300 V. Cond.
1—2500 KW. 2300 V. Cond
1—1250 KW. 2300 V. Cond.
1— 250 KW. 240 V. N. C.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1— 750 KW. 2300 V. Cond.
1— 500 KW. 440 V. N. C.
1— 500 KW. 125 V. D.C.
1— 375 KW. 440 V. Cond.
1— 120 KW. 440 V. N. C.

### ENGINE GENERATORS

1—540 KW. Uniflow 480 V.
1—150 KW. 480 V.
1—600 H.P. Uniflow Eng.
1—168 KW. 550 V.
2—280 KW. 440 V.
1—600 KW. 2300 V.

### TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

### BOILERS

1— 990 H.P. 200# Coal
1— 825 H.P. 175# Coal
1—1390 H.P. 400# Coal
2— 480 H.P. 225# Coal
1— 360 H.P. 190# Coal
2— 300 H.P. 250# Coal
1— 260 H.P. 200# Coal
2— 175 H.P. 200# Coal

### MOTOR

1—1250 H.P. G.E. Syn. Engine Type 2300 V.

### AIR COMPRESSORS

1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam
1—3000 C.F. 125# Motor
1—1570 C.F. 100# Motor
1—1247 C.F. 55# Motor
1—1214 C.F. 100# Motor
1— 600 C.F. 350# Steam

### AIR TANKS

3—10′ x 36″ Mass. Std.

### CONDENSERS

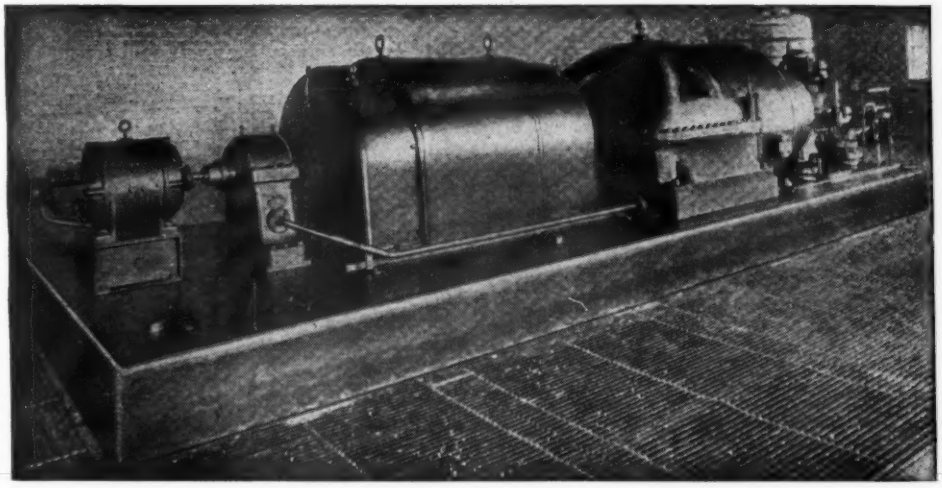
1—3100 Sq. Ft. Worth.
1—1485 Sq. Ft. Wheeler.

***Write or wire for additional data and prints.***

## A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

**The Buyer Must Be Satisfied—Always**

# TURBO-GENERATORS



*Units Noted Below Are Now In Our Stock—All Are 3 Phase, 60-Cycle, 3600-RPM*

7500—KVA. G.E. Sur. Cond., 190/375#: 2300-v.
6250—KVA. G.E. Sur. Cond., 200, 2300#-v.
5000 KVA. G.E., Sur. Cond., 200/400#: 2300/4000-v.
3750—KVA. G.E. Sur. Cond., 200#, 2300-v.
3125—KVA. G.E. Sur. Cond., 200#, 2300-v.
2500—KVA. G.E. Sur. Cond., 200#, 2300-v.
2000—KVA. G.E., Non-cond. 200#, 2300-v.
1875—KVA. G.E., COND. 200#.
1875—KVA, Elliott 300#-G, 2300-v.
1565—KVA. G.E. Sur. Cond. 150#, 2300
1250—KVA, Westinghouse, 200#, 2300-v.
1250—KVA, Allis-C. Non-cond. 150#, 840-v.
1250—KVA. West. Sur. Cond. 200#, 2300
1250—KVA, Allis-C. Non-cond. 150#, 480-v.
937—KVA. Allis-C. Cond. 200#.
937—KVA, G.E., 200#, Cond. 2300-v.
625—KVA, G.E., 200#, 2300-v.
375—KVA. G.E., Cond. 200#, 2300-v.

## WILMS, WEAVER & CO.

***Steam Turbine-Generator Specialists***

**4045 Penobscot Building** **Detroit (26) Michigan**

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**FOR SALE**
1—24"x36" Jaw Crusher & Elevator
1—250 HP Slip Ring Motor—Complete
1—75'x140' Steel Bldg.—4 yrs. old
1—312 KVA Generator D/C Full Diesel
2—400 HP, 200# P. Heine WT Boilers
1—75 & 50 KVA Gens. D/C Steam Engs.
1—150 HP Hercules Full Diesel Eng.
2—Automatic Battery Chargers for Diesels
**H. & P. MACHINERY CO.**
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**APPLICATION ENGINEERS**
50 KW—M. G. Syn. Set—440 AC to 250 DC.
500 KW—Westinghouse 240 V. Non-cond. turbine.
96 KW—240 Volt AC uniflow engine set.
375 KVA—480 Volt Ball 4-Valve engine set.
187 KVA—240 Volt Chuse 4-Valve engine set.
120 HP Fairbanks Morse Diesel engine.
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**DIESEL GENERATOR UNIT**
1500 H.P.—1250 KVA
Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
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**A.C. TURBINE UNITS**
5000 KVA GE 2300/4000 v. (bleeder)
3750 KVA GE 2300 v. Cond.
1560 KVA Wghse 480 v. (bleeder)
1556 KVA Al. Chal. 2300 v. Cond.
1250 KVA G.E. 2300 v. (bleeder)
937 KVA G.E. 2300 v. Cond.
750 KVA G.E. 2300 v. Cond.
625 KVA Wghse. 480 v. (bleeder)
625 KVA G.E. 2300 v. Cond.
625 KVA Ridge. 400 v. Non-Cond.
375 KVA G.E. 480 v. Cond.
375 KVA G.E. 2300 v. Non-Cond.
50 KVA Terry 480 v. Non-Cond.

**SPECIAL**
Two—310 HP Union Iron Works cross drum BOILERS; 175#; Detroit stokers; pumps, etc.

**UNIFLOW UNITS**
150 KVA G.E.-Filer Stowell
625 KVA Skinner Uniflow
350 KVA G.E.-Ames
312 KVA G.E. Chuse Uniflow
180 KVA W.E.-Chuse 4 v.
166 KVA Al. Chal.-Ames

**W. T. BOILERS**
1047 HP. (2) Heine 250#
758 HP. (2) Sterling 250#
500 HP. Heine; 200# (oil)
403 HP. Sterling 250#
365 HP. Kidwell, 200#
317 HP. (2) Heine 250#
310 HP (2) Union, 175#, cr. dr.
300 HP. Cleaver-Brooks; 125# (oil)
118 HP. B & W 160#

**DIESEL ENGINE UNITS**
375 KVA G.E. (2)-Worthington
225 KVA W.E.-Worthington
125 KVA W.E.-Worthington

# SEARCHLIGHT SECTION

## SLIP RING MOTORS
3-PH., 60 CY.

| HP | Volts | Make | Speed |
|---|---|---|---|
| 900 | 2300 | G.E. | 900 |
| 500 | 2300 | G.E. | 900 |
| 400 | 2300/440 | Whse. | 400 |
| 400 | 2300/440 | G.E. | 600 |
| 350 | 2300/440 | G.E. | 600 |
| 300 | 440 | Al. Chal. | 900 |
| 300 | 2200/440 | G.E. | 600 |
| 300 | 2200 | G.E. | 1800 |
| 250 | 2300 | G.E. | 600 |
| 250 | 440/550 | G.E. | 600 |
| 200 | 2200/440 | G.E. | 600 |
| 150 | 2200 | G.E. | 450 |
| 150 | 2200/440 | G.E. | 600 |
| 125 | 440/220 | G.E. | 1200 |
| 125 | 440/220 | G.E. (Hoist) | 900 |
| 100 | 220/440 | G.E. | 720 |
| 100 | 440/220 | G.E. MTC | 900 |
| 100 | 550 | G.E. | 900 |
| 100 | 2200 | G.E. | 900 |
| 100 | 2200 | G.E. | 1800 |
| 75 | 2200 | Al. Chal. (new) | 900 |
| 75 | 440/220 | G.E. (MTC) | 600 |
| 75 | 2200/440 | G.E. | 1200 |
| 60 | 2200/440 | G.E. | 600 |
| 75 | 550 | G.E. | 900 |
| 60 | 2200 | G.E. | 900 |
| 40 | 2200 | Whse. | 900 |
| 40 | 2200 | G.E. | 1200 |

## SYNCHRONOUS MOTORS
3-PH., 60 CY.

| | | | |
|---|---|---|---|
| 300 | 440/220 | Al. Ch. | 600 |
| 200 | 2200 | Whse. | 900 |
| 110 | 440 | Whse. | 900 |
| 100 | 2200/550 | Al. Ch. | 1800 |
| 100 | 440/220 | G.E. | 360 |
| 75 | 440/220 | G.E. | 720 |

## OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
3—NEW 400 amp., Type FKO 227, G. E., 7500 V., outdoor type, hand-operated.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt.

## TRANSFORMERS
60 CYCLE

4—1250 kva, Al. Chal., 13800-460/230 V.
3—833 kva. Whse., 11000-2300 V.
3—500 kva, G.E., type H, form KS, 13800-230/460.
3—333 kva., G.E., 66000-480 V.
1—300 kva., Whse., 3 Ph., 13800-230 V.
3—250 kva., Whse., 13,800-460.
3—200 kva., Whse., 11000Y-2300 V.
3—200 kva., G.E., 13300-480 V.
4—200 kva., G.E., NEW PYRANOL, 2300-450 V.
2—150 kva., G.E., type HTQ, 4150-240/480 V.
3—150 kva., G.E., H-KDD 13200-2300.
3—150 kva., G.E., H-KS, 2400-240/120 V.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950V-230/115.
3—100 kva., G.E., type H-KB 6600/11430V-2300 V.
3—100 kva., G.E., H-KDD, 6600/11950-230/115 V.
3—100 kva., G.E., H-KS, 2400-240/480 V.

## TURBO-GENERATOR SET

1—1121½ kva., 1200 rpm., 220/440 v., 3 ph., 60 cy., G.E., conn. to Terry, 3600 rpm., non-cond. turbine, 100/150 lbs. gu.

## SQUIRREL CAGE MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 500 | 440/220 | G | IK | 1200 |
| 500 | 440/220 | G.E. | IK | 900 |
| 400 | 2200/440 | Whse. | CS | 720 |
| 300 | 440 | Whse. | CS | 450 |
| 250 | 2200/440 | G.E. | IK | 600 |
| 250 | 2200 | G.E. | IK | 450 |
| 200 | 440/220 | G.E. | IK | 1200 |
| 150 | 440/220 | G.E. | KT | 720 |
| 150(3) | 440/220 | G.E. | KT | 1200 |
| 125 | 440 | G.E. | K | 514 |
| 125 | 440/220 | G.E. | KT | 1800 |
| 125 | 440/220 | G.E. | KT (Vert.) | 1800 |
| 100 | 440 | G.E. | IK | 450 |
| 100 | 2200 | G.E. | KT | 1800 |
| 100 | 440 | Whse. | CS | 1200 |
| 100 | 550 | Cr. Wh. | | 720 |
| 100 | 550 | G.E. | KT | 900 |
| 74 | 2200 | G.E. | KT | 900 |
| 50 | 2200 | Al. Chal. | | 720 |

## MOTOR GENERATOR SETS

1—75 KW, 250 V, 850 RPM, conn. to 110 HP, 440/220 V. Sq. Cage Motor.
1—50 KW, 250 V. 850 RPM, Whse. conn. to 75 HP. 440/220 V. 3 ph. 60 cy. Sq. Cage Motor.
1—50 KW, 125 V., 1200 RPM, Whse. conn. to 75 H.P. 2200/220 V.; 3 ph., 60 cy., Sq. Cage Motor
1—35 KW, 125 V., 1800 RPM., G.E., conn. to 50 HP., 440/220 V., 60 cy., squirrel cage.

## A.C. GENERATORS

1—375 kva, 514 rpm, 480/240 V. G.E.
1—250 kva, 600 rpm, 440/220 V. Al. Ch.
1—200 KVA, 600 RPM, 4150/2300 V., Cr. Wh.
1— 96 kva, 360 rpm. 480/240 V. G.E.

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HARRY J. RICE PRES.

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Several 450 lb. Boilers Available
2—1400 H.P. B. & W. 225-lb. Boilers
2—1060 H.P. Heine Boiler 200#
2— 825 H.P. B. & W. Sterling Boilers 200#
2— 750 H.P. Edge Moor 200# Boilers
3— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
2— 440 H.P. B. & W. Sectional 200# Oil Fired
4— 500 H.P. Heine 200 lb. Boilers
Smaller Boilers and Fire Tube Boilers also

1—15000 K.W., G.E. Co., Turbo-Generator Condensing
2—12500 K.W., G.E. Co., Turbo-Generator Condensing
1—5000 K.W., G.E. Co., Turbo-Generator Condensing
3— 4000 K.W., G.E. Co., Turbo-Generator Condensing
2— 2500 K.W., G.E. Co., Turbo-Generator Condensing
2— 2000 K.W., G.E. Co., Turbo-Generator Condensing
1— 2000 K.W., W. E. & M. Co., Turbo-Generator Con.
2— 1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 K.W., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units.

Non Condensing Turbos—300—500—750—and 1000 K.W. & Larger

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK

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## 1—680 KW NORDBERG UNAFLOW

*Engine Generator Set*

Left hand, non-condensing, full Poppet valve engine: General Electric 3/60/440, Generator: Belted 30 KW exciter. Complete and in Perfect Condition.

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1550 HP. Elec. Boat Engine 480 rpm.
300 KVA Fairbanks Morse 2400 V.
250 KW Ingersoll Rand 2200 V.
250 KW Busch Sulzer 240 V.
250 H.P. Busch Sulzer 257 rpm. Engine.
192 KW McIntosh Seymour 2300 V.
30—4-71 & 6-71 GM Engines
100 KW Busch Sulzer 2300 V.
12—11,500 & 20,000 Gal. Steel Tanks
R. C. STANHOPE, Inc., 60 E.42nd St., N.Y.17, N.Y.

FOR SALE

## CORLISS STEAM ENGINE

1—18" bore 42" stroke horizontal
250 H.P. fly-ball governor 9" out-board bearing 12' Dia. x 30" face fly-wheel. Perfect Condition.

FS-996, Power
330 W. 42nd St., New York 18, N. Y.

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## *Rebuilt and Sold with a Standard New Guarantee*

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D.C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

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Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

# CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

## MOTOR—GENERATOR SETS

| KW | Make | DC Volts | AC Volts |
|---|---|---|---|
| 800 | Wtg. | 275 Syn. | 3/60/13200 |
| 750 | Elliott | 275 Syn. | 3/60/440 |
| 500 | G.E. | 600 Syn. | 3/60/2300/4000 |
| 400 | Wtc. | 275 Syn. | 3/60/440 |
| 400 | G.E. | 250 Syn. | 3/60/2300 |
| 300 | G.E. | 250 Syn. | 3/60/480 |
| 225 | Ideal | 115 Syn. | 3/60/2200 |
| 200 | Elliott | 115 Syn. | 3/60/480 |
| 200 | Wtg. | 250 Syn. | 3/60/440 |
| 100 | G.E. 3 wire | Syn. | 3/60/480 |
| 75 | G.E. | 125 Ind. | 3/25/220 |
| 75 | G.E. | 125 Ind. | 3/25/440 |
| 90 | Wtg. | 110 75 KVA | 3/60/2300 |
| 60 | Al. Ch. | 110 Ind. | 3/60/2300 |
| 50 | G.E. | 115 Ind. | 3/60/440 |
| 35 | G.E. | 250 Ind. | 3/60/220 |
| 17½ | G.E. | 125 Ind. | 3/60/2200 |
| 7½ | Cr. Wh. | 125 balancer set | |
| 7½ | G.E. | 60 Ind. | 3/60/440 |
| 3 | Hertner | 65 Ind. | 3/60/220 |
| 3 | Hertner | 45 Ind. | 3/60/220 |
| 3 | Lincoln | 110 Ind. | 3/60/220 |
| 2.5 | Nwstn. | 110 Ind. | 1/60/220 |

## SLIPRING MOTORS

3 phase, 60 cycle

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 800 | Wtg. | CW | 6600 | 507 |
| 600 | G.E. | IM | 2200 | 1200 |
| 600 | Al. Ch. | ANY | 2200 | 1180 |
| 600 | Wtg. | CW | 2300 | 343 |
| 300 | G.E. | IM | 2200 | 514 |
| 150 | Wtg. | CW | 2200 | 1200 |
| 100 | Wtg. vert. | CW | 2200 | 1160 |
| 100 | Ideal | AV | 2200/440 | 720 |
| 100 | Westg. | HF | 440 | 230 |
| 75 | Nwstn. | HW | 220 | 1740 |
| 50 | Wtg. | HF | 440 | 860 |
| 60 | Al. Ch. | ARY | 220 | 690 |
| 50 | G.E. | 1-M | 220 | 850 |
| 50 | Al. Ch. | ARY | 220 | 690 |
| 50 | Wtg. | CW | 440 | 570 |
| 50 | G.E. | MT | 2200 | 600 |
| 40 | Cr. Wh. | 20Q | 220 | 1160 |
| 40 | Wagner | BR | 440 | 1750 |
| 40 | Al. Ch. | ARY | 220 | 1160 |
| 30 | G.E. | MT | 440 | 1150 |
| 30 | Wtg. | CW | 220 | 865 |
| 25 | G.E. | 1-M | 220 | 855 |
| 25 | G.E. | IM | 220 | 1140 |
| 25 | G.E. | IM | 220 | 855 |
| 15 | Wtg. C.W.-461C | | 220 | 1750 |

**FREQUENCY CHANGER**

**1—1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph. 60 cy. 460 volt, 300 RPM, 1570 amps, 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir/conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph. 25 cy. 460 volts, 300 RPM, 1570 amps. 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)**

## SQUIRREL CAGE MOTORS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 350 | G.E. | KT563 | 440 | 1765 |
| 150 | Wtg. | CS | 2200 | 720 |
| 200 | Wtg. | CS | 440 | 580 |
| 200 | G.E. | I-K | 440 | 580 |
| 150 | Al. Ch. | | 440 | 570 |
| 150 | G.E. | I-K | 440 | 1730 |
| 150 | G.E. | I-K | 440 | 575 |
| 150 | G.E. | I-K | 2250 | 580 |
| 125 | G.E. | I-K | 220 | 1165 |
| 100 | Wtg. | CS | 440 | 1160 |
| 100 | Wtg. | CS | 2200 | 870 |
| 100 | G.E. | KF | 440 | 900 |
| 75 | G.E. | KT | 2200 | 1800 |
| 75 | Al. Ch. | ARY | 2200 | 1800 |
| 75 | Wtg. | CS | 2200 | 800 |
| 60 | Wtg. | CS vert. | 2200 | 1750 |
| 60 | G.E. | KT333 | 220 | 1740 |
| 60 | G.E. | K504 | NEW | 1200 |
| 60 | G.E. | KT346 | 440 | 865 |
| 60 | G.E. | KT | 440 | 865 |
| 50 | G.E. | KT333 | 220 | 1740 |
| 50 | G.E. | KT | 440 | 1165 |
| 50 | G.E. | KT | 2200 | 900 |
| 50 | Wtg. | CS | 440 | 699 |
| 50 | Al. Ch. | | 440 | 570 |
| 50 | Cr. Wh. | | 220 | 1200 |
| 40 | G.E. | KF44Y | 2200 | 1745 |
| | | gear type to 581 RPM | | |
| 40 | G.E. | K440 | NEW | 1200 |
| 40 | Cr. Wh. | | 220 | 1800 |
| 40 | G.E. | KT327 | 220 | 1745 |
| 40 | Al. Ch. | | 440 | 850 |
| 40 | G.E. | KT | 2200 | 900 |

## SQUIRREL CAGE MOTORS

| HP. | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 30 | Al. Ch. | ARZ | 440 | 695 |
| | | tot. enc. fan cld. | | |
| 35 | Wtg. | CS | 2200 | 1170 |
| 35 | G.E. | 1-K | 440 | 680 |
| 30 | G.E. | KF-405 | 440 | 1800 |
| 35 | Al. Ch. | | 440 | 480 |
| 30 | G.E. | KT | 220 | 600 |
| 30 | Al. Ch. | AR | 440 | 685 |
| 35 | G.E. | KT | 220 | 900 |
| 35 | G.E. | IK | 440 | 1200 |
| 25 | Ideal | A-A-8015 | 220 | 1740 |
| 25 | G.E. | KT | 440 | 600 |
| 25 | G.E. | K-364 | NEW | 1800 |
| 25 | Howell | SC | 220 | 600 |
| 25 | G.E. | KT | 220 | 1125 |
| 20 | Cr. Wh. | 1170 | 440 | 1140 |
| 20 | Wagner | 195BP | 220 | 1200 |
| 20 | G.E. | TEFC | NEW | 1800 |
| 20 | G.E. | K864 | NEW | 1800 |
| 20 | G.E. | KT326 | 220 | 870 |
| 20 | G.E. | KF | TEFC | 1800 |
| 20 | Al. Ch. | AN | 220 | 850 |
| 20 | Westg. | CCL | 220 | 850 |
| 20 | Reliance | 60AA | 440 | 1750 |
| 20 | Westg. | CS | 440 | 1200 |
| 20 | Wagner | 15VRN | 440 | 1200 |
| 15/5 | G.E. | KF404 TECF | | 1775/560 |
| 15 | L. Allis | OX326X | 440 | 1760 |
| 15 | G.E. | I-K | 440 | 1200 |
| 15 | Al. Ch. | AR216 | 440 | 900 |
| 15 | Comm. | P404 | 220 | 900 |
| 15 | G.E. | I-L | 220 | 720 |
| 10 | F.M. | UJL | vert. | 1750 |
| 10 | Lincoln | I-K | 440 | 1200 |
| 7½ | F. M. vert. | UHI | 220/440 | 3470 |
| 7½ | Westg. | CS324 | 220/440 | 1150 |
| 7½ | Comm. | P324 | 220/440 | 1150 |
| 5 | G.E. | K254 | NEW | 1800 |
| 5 | U. S. | 358 | 220 | 1200 |
| 3 | G.E. | KT713 | 220 | 3460 |
| 3 | Westg. | CS234 | 220 | 1140 |
| 3 | Willey | intm.d. | 440 | 1050 |
| 3 | C. Wh. | TEFC | 220/440 | 1720 |

## TRANSFORMERS

Single phase, 60 cycles

| Qu. | kva | Make | Type | Voltage |
|---|---|---|---|---|
| 3 | 1000 | | SC | 13200/480 |
| 3 | 833 | | SC | 6600/2300 |
| 2 | 100 | G.E. | H | 1200/220/440 |
| 1 | 100 | Wtg. | SK | 6900/115/230 |
| 1 | 100 | Wtg. | AVR | 480/240 |
| | | weatherproof enclosure | | |

## TRANSFORMERS

| Qu. | Kva | Make | Type | Voltage |
|---|---|---|---|---|
| 1 | 100 | Wtg. | SK | 2300/110/220 |
| 3 | 75 | Wtg. | S | 3810/244/122 |
| 2 | 75 | Wtg. | S | 2200/110/220 |
| 1 | 75 | G.E. | H | 2300/230/460 |
| 8 | 50 | G.E. | H | 2200/220/440 |
| 1 | 50 | Pitts. | | 13200/6600 |
| 3 | 50 | Moloney | HE | 2300/230/460 |
| 3 | 50 | Pitts. | | 2200/110/220 |
| 1 | 50 | G.E. | H | 12000/110/220/440 |
| 1 | 40 | Packard | A | 2200/110/220 |
| 1 | 40 | G.E. | H | 2300/230/460 |
| 1 | 40 | Pitts. | | 2200/110/220 |
| 1 | 37½ | G.E. | H | 2300/230/460 |
| 2 | 37½ | G.E. | H | 12000/230/440 |
| 1 | 37½ | G.E. | H | 26400/2300 |
| 1 | 30 | G.E. | H | 2300/110/220 |
| 1 | 30 | Moloney | HE | 13200/230 |
| 1 | 25 | G.E. | H | 2300/2300 |
| 1 | 20 | Kuhlman | | 2300/115/230 |
| 1 | 20 | Moloney | | 1100/2200/110/220 |
| 4 | 20 | G.E. | | 1100/2200/110/220 |
| 1 | 20 | G.E. | H | 2200/220/440 |
| 1 | 15 | G.E. | H | 6900/2300 |
| 1 | 15 | G.E. | H | 2400/120/240 |
| 1 | 15 | G.E. | A | 1050/2200/288 |
| 1 | 15 | Pitts. | 25 cy. | 2200/110/230 |
| 3 | 15 | G.E. | H | 13000/2300 |
| 1 | 15 | G.E. | H | 11000/2200 |
| 1 | 15 | G.E. | H | 440/110/220 |
| 3 | 15 | Albertson | | 2300/115/230 |
| 1 | 15 | Westg. | S | 2300/115/230 |
| 2 | 10 | G.E. | A | 2200/110/220 |
| 1 | 10 | Moloney | HE | 2300/110/220 |
| 1 | 10 | Stanley | BQ | 2200/110/220 |
| 1 | 10 | W.E. | T | 2200/110/220 |
| 1 | 10 | Packard | | 2200/110/220 |
| 3 | 10 | G.E. | | 2200/110/220 |
| 1 | 10 | Wtg. | S | 2200/110/220 |
| 4 | 7½ | G.E. | H | 2200/110/220 |
| 1 | 7½ | G.E. 3 ph. | HT | 2200/220/440 |
| 2 | 7½ | Wtg. | S | 2200/110/220 |
| 1 | 7½ | Moloney | HE | 6900/115/230 |
| 1 | 7½ | Moloney | HE | 2300/115/230 |
| 1 | 7½ | W.E. | T | 2200/110/220 |
| 1 | 6 | Kuhlman | air | 100/20 |
| 1 | 6 | Sorgel So | air | 140/20 |

**This is a partial listing, only have NEW from ¼ to 75 hp right in stock.**

**WE ARE ALWAYS IN THE MARKET FOR ALL TYPES OF GOOD MODERN ELECTRIC MOTORS, MOTOR-GENERATOR SETS GENERATORS, TRANSFORMERS, AND OTHER ELECTRICAL EQUIPMENT. SEND US YOUR LISTS FOR BEST CASH OFFERS.**

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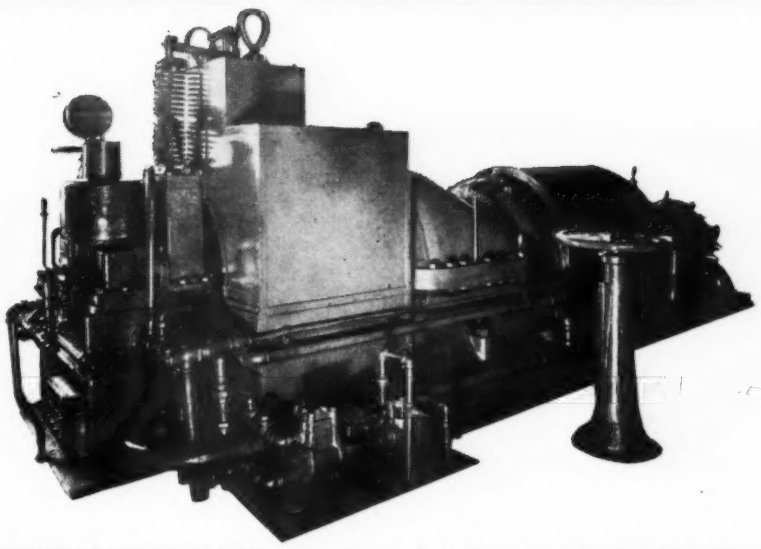
# DEPENDABLE TURBINE-GENERATORS

IF UNIT Desired is Not Listed Send Your Specifications.



**SPECIALS**

7500-KVA, G.E.

1500 KW, G.E.

*Write for Specifications Prices*

**WESTINGHOUSE 1000-KW, Aut. Extraction-Condensing Turbine-Generator**

7500—KVA. G.E. Sur. Cond. 190 375#: 2300-v.
6250—KVA. G.E. Sur. Cond. 200 2300#-v.
5000—KVA. G.E. Sur. Cond. 200 400#: 2300 v.
3750—KVA. G.E. Sur. Cond. 200# 2300-v.
3125—KVA. G.E. Sur. Cond. 200# 2300-v.
2500—KVA. G.E. Sur. Cond. 200# 2300-v.
1565—KVA. G.E. Sur. Cond. 150# 2300
1250—KVA. Westinghouse, 200# 2300-v.
1250—KVA. West. Sur. Cond. 200# 2300
1250—KVA. Allis-C. Cond. 150# 480-v.
937—KVA. Allis-C. Cond. 200#.
937—KVA. G.E. 200# Cond. 2300-v.
625—KVA. G.E. 200# 2300-v.

## WILMS, WEAVER & CO., 4045 Penobscot Bldg., Detroit, Mich.

*STEAM TURBINE-GENERATOR ENGINEERS*

# IN STOCK!

**GENERATORS**

One 250 K.V.A. and one 300 K.V.A. Crocker Wheeler Generators direct connected to Skinner Tandem compound engines—480 volts—3 phase 60 cycle, switchboard, instruments, piping.

One 300 K.W. General Electric Generator, 2300 v., 3 ph., 60 cy., direct connected to Curtis Steam Turbine, 175 lbs. pres.—3600 R.P.M. with 15 K.W. G.E. direct connected exciter.

**ELECTRIC MOTORS**

**Induction Type—220 V.—2 Ph.—60 Cy.**

1—5 H.P. Burke—Type EB 5—1130 RPM.
1—5 H.P. Burke—Type EB 75—900 R.P.M.
1—7½ H.P. R&M—TYPE K—850 R.P.M.
1—10 H.P. Burke—Type EM 1.2—900 R.P.M.
2—20 H.P. Burke—Type EM 3—1200 R.P.M.
1—20 H.P. Crocker Wheeler—1170 R.P.M.
1—35 H.P. Burke—Type EM—4.5—900 R.P.M.
1—50 H.P. Burke—Type EM—4.5—1200 R.P.M.
1—150 H.P. West—Type CW—1765 R.P.M.
1—7½ H.P. totally enclosed—fan cooled—1200 R.P.M.

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One Quimby 4 stage Centrifugal pump direct connected to 75 H.P. G.E. motor—220 volts—3 phase, 60 cycle, 1750 R.P.M.—500 G.P.M. 150 lbs. pressure.

One American Well 2 stage Centrifugal pump direct connected to 30 H.P. G.E. motor, 220 v., 3 ph., 60 cy., 1750 R.P.M. 200 ft. head complete with magnetic starter and safety switch.

**DEEP WELL PUMPS**

3—American Well Works; capacities 85, 165 and 200 g.p.m. with 10, 15 and 20 H.P. Motors; Current 220 volts, 3 phase, 60 cycle.

**FEED WATER PUMPS**

1—Warren Duplex—Size 10" x 7" x 12" Brass Lined & Fitted—Stainless Piston Rods
1—Worthington Duplex—Size 9" x 5¼" x 10" Stainless Piston Rods

**FEED WATER HEATERS**

One Goubert feed water heater with brass tube—330 sq. ft. heating surface.
One Cochrane feed water heater, 54" dia. x 48" long—1500 H.P. capactiy.

**BOILERS**

One 444 H.P. Union Iron Works, water tube steam boiler 200 lb. working pressure, pulverized coal or oil fired.

**STEAM ENGINE**

40 H.P. Nagle vertical steam engine, Class F. 12" cylinder, 12" stroke, flywheel 54" x 12½".

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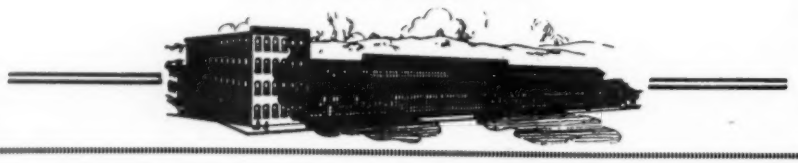

## TURBO GENERATORS

1—2000 KW General Electric Turbo-Generator, 2500 KVA, 6600 Volts, 219 Amps, 3600 RPM, Type ATB, Form HT, direct-connected exciter with Elliott Jet Type Condenser, Serial No. 4219008.
1—1250 KW General Electric Turbo-Generator, Type ATB, Form HT, 3600 RPM, direct-connected exciter, Wheeler Jet Condenser.
1—2750 KW General Electric Turbo-Generator. Steam pressure 150 lb., A.C. Generator, Type AQB, Class 4—Form HT, Speed 1800 RPM, Volts 2300, Amps 598. W.M. Kellogg Co. Twin Bulkley Injector Condenser.
1—2000 KW General Electric Turbo-Generator, 180 lb. pressure, 3600 RPM Generator, Type ATB, 600 Volt AC, 2403 Amp, with Westinghouse-Le Blanc Jet Condenser.
1—750 KW General Electric Turbo-Generator, 150 lb. Pressure, type ATB, Form HT, 600 Volts, Speed 3600 RPM, with Westinghouse-LeBlanc Jet Condenser.

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3—400 HP Casey Hedges Water Tube Boilers.
1—500 HP Casey Hedges Water Tube Boiler. Foster Superheater. These boilers are oil fired, system-complete, automatic draft control equipment, etc.
3—308 HP Heine Water Tube Boilers.
1—518 HP Heine Water Tube Boiler.

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300 KW Gen. Elec. type MPC gen. DC 170 volts 1760 amp. coupled to 450 HP G.E. MPC motor DC 250 V. 1150 RPM (can furnish A.C. drive).
100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage 1-K motor 3-60-2200/4000 V.—1200 RPM.
50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440 V. 1800 RPM.
40 KW Martin rotary converter, input 3/60/220 v., output DC 230 v., with panel.
35 KW Gen. Elec. DLC gen. DC 250 V. to 50 HP AC motor 3-60-220/440 V.
30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v. 1160 RPM. late style 3 brg. unit.
25 KW Gen. Elec. LC gen. DC 250 V. to 40 HP G.E. KT 532 motor 3/60/220/440 V.
20 KW Whse. SK gen. DC 250 v. coupled to 30 HP Whse. CS444 motor 3/60/220/440 volts.
**Others available—special units built to order.**

### D. C. MOTORS

| H.P. | Mfg. | Type | Volts | Speed |
|---|---|---|---|---|
| 450 | Gen. Elec. | MPC | 230 | 1150 |
| 75 | Whse. | S13 | 125 | 475 |
| 75 | Gen. Elec. | DLC | 230 | 400 |
| 50 | G.E. Sprague | LC | 250 | 700 |
| 50 | Whse. | SA | 230 | 450/1350 |
| 40 | Gen. Elec. | DLC | 230 | 750 |
| 40 | Roth | S | 115 | 850 |
| 30 | Allis Ch. | E100 | 230 | 1800 |
| 30 | Sprague | dynamom | 250 | 800/2000 |
| 25 | Gen. Elec. | DLC | 115 | 750 |
| 25 | Roth | elevator | 230 | 725 |
| 25 | Whse. enclosed | SK | 230 | 600 |
| 25 | Gen. Elec. | CD93 | 230 | 1150 |
| 25 | Whse. | SK | 230 | 950 |
| 25 | Sprague dyna. | LC | 115 | 700/1500 |
| 25 | Gen. Elec. | RC32 | 230 | 800 |
| 20 | Imperial int. dty | D37 | 230 | 1200 |
| 20 | Gen. Elec. | RF12 | 230 | 400/1200 |
| 20 | Gen. Elec. | DLC | 230 | 500/1500 |

# OUR 40th ANNIVERSARY—1906 1946

### SQUIRREL CAGE MOTORS
**3 Phase—60 Cycles—220 or 440 Volts**

| Qua. | H.P. | Mfr. | Type | Speed |
|---|---|---|---|---|
| 2 | 150 | Gen. Elec. | I-K | 900 |
| 1 | 75 | Allis Ch. | AN | 720 |
| 2 | 60 | Gen. Elec. b.b. | K444 | 1800 |
| 1 | 75 | Whse. b.b. | CS505 | 1800 |
| 2 | 60 | Gen. Elec. | I-K | 3600 |
| 1 | 60 | Allis Ch. | B | 600 |
| 4 | 50 | Whse. b.b. | CS504 | 1200 |
| 2 | 50 | Gen. Elec. vertical | KT | 1200 |
| 2 | 50 | Gen. Elec. | I-K | 900 |
| 1 | 40 | Gen. Elec. | KT323 | 3600 |
| 2 | 40 | Allis Ch. | AN | 1200 |
| 1 | 40 | Gen. Elec. | KT332 | 1200 |
| 1 | 30 | Wagner | 19TBP | 1800 |
| 6 | 30 | Whse. b.b. | CS444 | 1200 |
| 1 | 30 | G.E. TEFC b.b. | KF444 | 1200 |
| 2 | 30 | Allis Ch. | AN | 1200 |
| 3 | 30 | Allis Ch. | AN | 900 |
| 1 | 30 | Howell | SC | 720 |
| 1 | 25 | F. Morse b. b. | H | 3600 |
| 3 | 25 | Gen. Elec. b.b. hitorq | KTR526 | 1200 |
| 1 | 25 | Whse. New. | CS365 | 1800 |
| 1 | 25 | Gen. Elec. | KT322 | 1200 |
| 2 | 25 | Allis Ch. | AN | 900 |
| 2 | 20 | L. Allis splash, b.b. | FX364 | 1800 |
| 4 | 20 | G.E. splash. b.b. | K405 | 900 |
| 1 | 20 | Allis Ch. | AN | 900 |
| 2 | 20 | Gen. Elec. | I-K | 1200 |
| 1 | 20 | Ideal | AA | 1200 |
| 3 | 20 | Gen. Elec. | KT312 | 1200 |

### 25 CYCLE MOTORS

| H.P. | Mfg. | Type | Speed |
|---|---|---|---|
| 450 | Whse. 2200 v. | CW sl. rg. | 750 |
| 150 | Whse. | HD sl. rg. | 500 |
| 150 | Gen. Elec. 2200 v. | MT359 sl. rg. | 1500 |
| 100 | Whse. | CCL sq. cg. | 500 |
| 100 | Gen. Elec. | I-Kq. cg. | 500 |
| 50 | Allis Ch. | ANY sl. rg. | 1500 |

### SYNCHRONOUS MOTORS

| H.P. | Mfg. | Type | Volts | Speed |
|---|---|---|---|---|
| 750 | Allis Ch. | | 220/440 | 1200 |
| 350 | Gen. Elec. 3 brg. | ATB | 220/440 | 600 |
| 300 | Whse. | ped. | 220/440 | 900 |
| 290 | Gen. Elec. | ATI | 220/440 | 600 |
| 250 | Gen. Elec. | ATI | 220/440 | 514 |
| 250 | Gen. Elec. 1 brg. | ATI | 220/440 | 600 |
| 75 | Ideal | SMS | 220/440 | 1200 |
| 40 | Gen. Elec. 8. PF | TS | 220/440 | 900 |

**CENTRIFUGAL PUMPS**
**10" Weinman, 2500 gpm @ 40 ft.**
**8" Alberger, 2000 gpm @ 80 ft.**
**6" Platt, 1000 gpm @ 230 ft.**
**8" Worthington, 2000 gpm @ 200 ft.**

### SLIP RING MOTORS
**3 Phase—60 Cycles—220 or 440 Volts**

| Qua. | H.P. | Mfg. | Type | Speed |
|---|---|---|---|---|
| 1 | 350 | Whse. 2200 v. | CW | 720 |
| 1 | 300 | Burke | EMV | 225 |
| 1 | 300 | Whse. | HF | 400 |
| 1 | 300 | Gen. Elec. | I-P | 720 |
| 1 | 250 | Gen. Elec. | I-M | 600 |
| 1 | 200 | Gen. Elec. | I-M | 600 |
| 1 | 150 | Gen. Elec. 2200 v. | MT | 1200 |
| 1 | 100 | Gen. Elec. 2200 v. | I-E13A | 1800 |
| 1 | 75 | Gen. Elec. | MT537 | 1800 |
| 1 | 75 | Gen. Elec. 2200 v. | I-E13 | 1800 |
| 1 | 75 | Lincoln | IXV | 600 |
| 1 | 65 | P. & H. b.b. Int. | CA16 | 900 |
| 1 | 60 | Whse. 2200 v. | CW657 | 1800 |
| 1 | 50 | Gen. Elec. | MT536 | 1200 |
| 1 | 60 | Gen. Elec. | MT536 | 1200 |
| 1 | 50 | Gen. Elec. | I-M | 600 |
| 1 | 40 | Gen. Elec. 2 ph. | MQ536 | 900 |
| 1 | 40 | North'n | HW35A | 1200 |
| 2 | 40 | Gen. Elec. | MT532 | 1200 |
| 1 | 40 | Fair. Morse b.b. | HV | 1200 |
| 1 | 40 | Whse. | CW | 900 |
| 2 | 40 | Gen. Elec. | M546 | 514 |
| 2 | 40 | Allis Ch. | ANY | 450 |
| 1 | 40 | G.E., 550 v. | MT536 | 900 |
| 1 | 35 | Fair. Morse b.b. | HV | 1800 |
| 1 | 35 | Gen. Elec. | I-M | 900 |
| 3 | 35 | Lancashire b.b. | Late | 1800 |
| 1 | 30 | Whse. 550 v. | CW | 900 |
| 1 | 30 | Northwestern b.b. | HW404 | 1800 |
| 2 | 30 | Allis Ch. | ANY | 900 |
| 2 | 30 | Whse. enclosed | MA | 600 |

### D. C. GENERATORS

| KW | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 300 | Gen. Elec. 1 brg. | MPC | 125/170 | 1150 |
| 150 | Gen. Elec. | MP | 250 | 600 |
| 75 | Whse. | S | 125 | 600 |
| 60 | Gen. Elec. | DLC | 250 | 450 |
| 50 | Cr. Wheeler | CC | 125 | 1800 |
| 35 | Gen. Elec. | DLC | 250 | 900 |
| 30 | Lincoln b. b. 600 amp. | | 50 | 1200 |
| 25 | Gen. Elec. | DLC | 125 | 900 |
| 25 | Gen. Elec. | DC | 250 | 900 |
| 20 | Allis Ch. (2) | | 125 | 475 |
| 16 | Cr. Wheeler | CCD | 125 | 415 |

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### 60 CYCLE A.C. GENERATORS

| KVA | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 500 | Gen. Elec. 3 brg. | ATB | 2300 | 450 |
| 300 | Gen. Elec. 3 brg. | ATB | 240/480 | 600 |
| 300 | Whse. | ped. | 240/480 | 900 |
| 360 | Elec. Machy. 3 brg. | | 240/480 | 720 |
| 250 | Gen. Elec. 1 brg. | ATB | 240/480 | 600 |
| 150 | Allis Ch. | | 2300 | 900 |
| 150 | Allis Ch. 25 cycle | | 240/480 | 500 |
| 100 | Cr. Wheeler | ped. | 240/480 | 600 |

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**937 KVA., 3 ph., 60 cy., 2300V. Gen. Elec. cond. Turbo Generator.**

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**1—1500 KW., 250 V. Westgh. complete.**

**1—156 KVA., 3 ph., 60 cy., 240 volt Gen. Elec. to an 8 cylinder Buffalo engine only 5 years old, little used.**

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| 80 Ton "American" 40'6" | 15 Ton Cleveland 55'6" | 10 Ton Northern 71'10½" |
| 75 Ton Alliance 37' Span | 15 Ton Cleveland 35' Span | 7½ Ton Erie 70' Span |
| 75 Ton Alliance 78' Span | 15 Ton Morgan 77' Span | 7½ Ton P & H 30'6" Span |
| 50 Ton Cleveland 71'10½" | 15 Ton Niles 32' Span | 7½ Ton Scullin 71'10½" |
| 50 Ton Shaw 69'10" Span | 15 Ton Northern 53' Span | 7½ Ton Shepard 36' Span |
| 40 Ton Alliance 82' Span | 15 Ton Shaw 82' Span | 6 Ton Shaw 23' Span |
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| 25 Ton Whiting 106' Span | 10 Ton Emsco 30' Span | 5 Ton Toledo 96' Span |
| 25 Ton Whiting 82' Span | 10 Ton Lane 50' Span | 5 Ton Whiting 80' Span |
| 25 Ton Whiting 56' Span | 10 Ton Morgan 39'5" Span | 3 Ton P & H 46'4" Span |
| 20 Ton Alliance 77' Span | 10 Ton Morgan 77' Span | 3 Ton Shaw 33' Span |
| 20 Ton Cleveland 65' Span | 10 Ton P & H 57' Span | 3 Ton Whiting 57'3" Span |
| 20 Ton Morgan 77' Span | 10 Ton P & H 78' Span | 2 Ton Detroit 28' Span |
| 20 Ton Northern 60' Span | 10 Ton P & H 87'6" Span | 2 Ton P & H 46'4" Span |
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| 20 Ton P & H 51'4" Span | 10 Ton P & H 48'10½" Span | 1½ Ton Cleveland 25' Span |
| 20 Ton Shaw 76'4" Span | 10 Ton P & H 60' Span | 1½ Ton P & H 34' Span |
| 20 Ton Shepard Niles 49'6" | 10 Ton P & H 80' Span | 1 Ton Curtis 24' Span |

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**1—2500 KVA 26400/13200—460 V., 3-ph.**

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Coils have been regalvanized and not used since.
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## 1—Ingersoll-Rand Imperial type #10 Air Compressor with tank and motor

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**FOR SALE**

## 1—Kroeschel 500 H.P. Sterling type four drum water tube boiler

Complete with all usual fittings including Copes feed water regulator and 8" Edwards Non-Return Valve. Boiler built for 200 P.S.I. and installed in 1935. It is equipped with 3 Hoffman Firite Stokers complete with motor drive. Forced draft fan direct connected to a 10 H.P. 1160 R.P.M. 220-volt, 3 phase 60 cycle motor. Complete coal handling equipment including coal bins of about 175 tons capacity.

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**2 ERIE CITY longitudinal, box header water tube boilers with Type-E, stokers, 400 H.P. (each) headers are equipped with KEY CAPS—OHIO, PENN'A. & ASME Stamping.**

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Including fully automatic panel boards, voltage regulator, Motor generator and balancing sets, transfer pumps, etc., also 230 volt set of Philco heavy duty Batteries 420 amps hr., practically new. This is one of the finest and most complete plants offered in some time.

**ALJON ELECTRIC DIESEL CO.**
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FOR SALE

## DIESEL ENGINE

Lister type JP 38 Horse Power with generous supply of spare parts; also a Star continuous duty 5 KW Generator; 3 phase, 60 cycle, 120/208 volts, 1800 R.P.M.

**WATERVILLE MFG. CO.**
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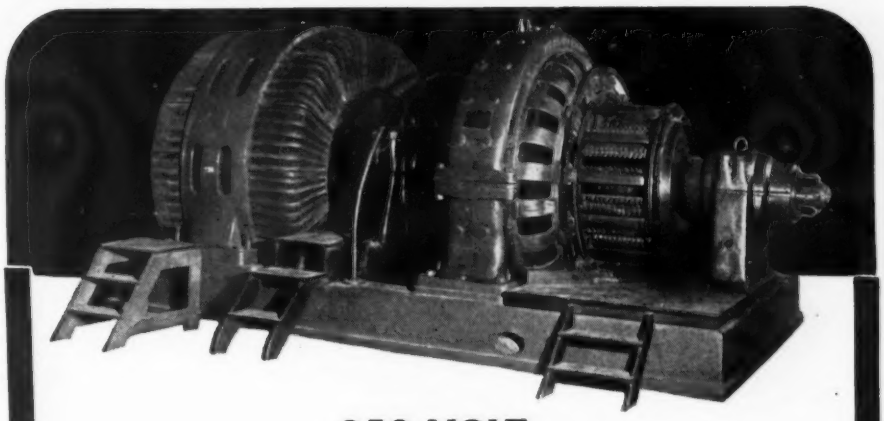

## 250 VOLT MOTOR GENERATORS

| KW. | Make | Speed | Drive |
|---|---|---|---|
| 500 | GE | 720 | 60 cy. syn. |
| 400 | GE | 600 | 60 cy. syn. |
| 400 | GE | 1200 | 60 cy. syn. |
| 300 | West | 720 | 60 cy. syn. |
| 200 | GE | 1200 | 60 cy. syn. |
| 150 | West | 850 | 60 cy. sq. cg. |
| 150 | Al.-Ch. | 500 | 25 cy. rot. |
| 125 | Hertner | 1200 | 60 cy. syn. |
| 100 | GE | 1200 | 3 wire 60 cy. |
| 100 | GE | 750 | 25 cy. rot. |
| 75 | GE | 1200 | 60 cy. syn. |
| 50 | West | 1200 | 60 cy. sq. cg. |
| 40 | GE | 1800 | 60 cy. syn. |
| 25 | GE | 1800 | 60 cy. sq. cg. |
| 15 | GE | 1200 | 60 cy. sq. cg. |
| 15 | GE | 750 | 25 cy. sq. cg. |
| 10 | West | 900 | 60 cy. sq. cg. |
| 5 | Rel. | 1800 | New VS |
| 3 | Rel. | 1800 | New VS |

### 125 VOLT MOTOR GENERATOR SETS

| KW. | Make | Speed | Drive |
|---|---|---|---|
| 200 | GE | 750 | 25 cy. syn. |
| 150 | West | 1200 | 60 cy. syn. |
| 125 | | 900 | 60 cy. slip |
| 100 | West | 1200 | 60 cy. syn. |
| 75 | GE | 1200 | 60 cy. sq. |
| 75 | GE | 1200 | 60 cy. sq. |
| 50 | Sprague | 900 | 60 cy. sq. |
| 50 | GE | 750 | 25 cy. sq. |
| 50 | West | 750 | 25 cy. sq. |
| 35 | West | 750 | 25 cy. sq. |
| 35 | Sprague | 750 | 25 cy. sq. |
| 25 | West | 1800 | 60 cy. sq. |
| 20 | West | | 60 cy. sq. |
| 12 | GE | 1800 | 60 cy. 3 wire |
| 10 | GE | 1800 | 60 cy. 3 wire |
| 5 | Reliance | 1800 | new |

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**550 Volt D. C. Motors**

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1—120 HP Fairbanks-Morse with AC Generator
10—75 HP New International Harvester UD-18 with AC Generators
12—65 HP New International Harvester UD-14 with AC Generators
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2—Type B, Frame 284, 5 KW, 300 V. Auxiliary Generators.
1—Type B, Frame 225, 2 KW, 250 V. Exciter.

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Type B, Frame 284, 5 HP, 1 Hr. 55°, 300 V., 1750 RPM, Variable Speed By Armature and Field Control.

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**Holyoke, Massachusetts**

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**FOR SALE**

2—200 HP COOPER-BESSEMER FULL DIESEL ENGINES, Solid Injection, 6 Cyl., 4 Cy., 325 RPM, 11" x 14", Type JRS. Quantity of spare parts. Immediate delivery as taken out of service.

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1—1392 HP Springfield sectional Header 400#.

2—617 HP Wickes 3 Drum, low head, 250# pressure, with forced draft chain grate stokers.

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1—350 KW Burch Sulzer 3-60-2300 Volt, all auxiliaries.

4—Burch Sulzer Full Diesel direct connected 1335 KW AC. generator, rebuilt and guaranteed.

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1—700 KVA Ames Uniflow Engine Generator.

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1—150 KW Skinner Uniflow Engine Generator Set A.C.

1—600 KW Skinner Vertical D.C. 3 Wire Set.

1—500 KW Non Releasing Corliss, 3-60-240 volts.

## MISCELLANEOUS

90,000 pound Cochrane Hot Process Lime & Soda Softener.

2500 HP Cochrane Open Feed Water Heater.

1—10' x 15' Illinois Forced Draft Chain Grate Stoker.

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| 1—35 H.P. | G.E. | ITC 5012 | 1150 RPM |
| 1—30 H.P. | G.E. | ITC 5010 | 1145 RPM |
| 1—75 H.P. | G.E. | ITC | 850 RPM |
| 1—30 H.P. | WE&M | CI | 690 RPM |
| 1—15 H.P. | WE&M | CI | 690 RPM |
| 1—15 H.P. | WE&M | CI | 850 RPM |
| 1—40 H.P. | G.E. | MQC 5322 | 1200 RPM 2 ph. |
| 1—20 H.P. | G.E. | MTC 312 | 1150 RPM |
| 2—50 H.P. | WE&M | 658-A | 575 RPM |
| 2—52 H.P. | G.E. | ITC 5013 | 575 RPM |
| 1—35 H.P. | WE&M | CI | 690 RPM |
| 1—15 H.P. | Ideal | A-80-15 | 1200 RPM |
| 1—50 H.P. | G.E. | MTC | 600 RPM |

**230 VOLTS D. C. MOTORS**

| | | | |
|---|---|---|---|
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| 2—7½ H.P. | WE&M | SK | 850 SH Sealed Sleeve |
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| 4—25 H.P. | WE&M | SK | 1750 SH ball bearing |
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**Sq. Cage—220/440 V. 60 Cy. 3 ph.**

| Qu. | HP | Make | Type | Speed |
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| 2 | 100 | G. E. | IK | 1800 |
| 1 | 150 | West. | CS | 1800 |

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| | | | | |
|---|---|---|---|---|
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| 1 | 50 | G. E. | I-M | 900 |
| 1 | 60 | G. E. | I-M | 900 |
| 1 | 75 | West. | CW | 900 |
| 1 | 250 | West. | CW | 1200 |

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| | | | | |
|---|---|---|---|---|
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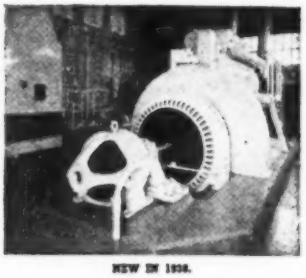
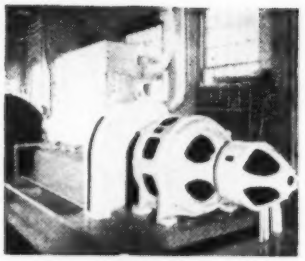


NEW IN 1938.



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|---|---|---|---|---|
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| 360 HP Fairbanks | 6 cyl | 300 KVA | 3/60/2400 | 1932 |
| 330 HP G. M. Winton | 4 cyl | 282 KVA | 3/60/240 | 1937 |
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1—3125 Kva. G.E. Turbo 230 V. 60 Cy. 3 ph.
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1500 and 2500 HP. 60 CY. A.C. Motors, 435 and 257 Rev.

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**3 phase 208 volts 60 cycles**

| H.P. | Make | RPM |
|---|---|---|
| #3 | Imperial | 1135 |
| 7 | Lincoln | 1200 |
| 7.5 | Otis | 900 |
| 10 | Otis | 900 |
| 20 | G E | 650 |
| 20 | Westinghouse | 850 |
| 20 | Lincoln | 1200 |
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| 35 | Lincoln | 720 |

Also a large stock of 2 phase motors

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Benjamin's for Motors
ESTABLISHED 1904
Windsor 5-1700
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## 500 H. P.
## WESTINGHOUSE SLIP-RING MOTOR

3 phase, 60 cycle, 2200 volts, 360 RPM, serial number 1840531, sleeve-bearing, completely overhauled and carries out usual guarantee. Wire or phone order immediately.

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2—62½ K.W. Chuse 4 valve, balanced slide valve, steam engines 125# pressure 5# back. Direct connected to Westinghouse D.C. Generators, 3 wire 115/230 volts.
1—37½ K.W. Chuse balanced single valve, steam engine 125# pressure 5# back. Direct connected to Westinghouse D.C. Generator 3 wire 115/230 volts.

Complete with separators, balancing coils and gen. panels (few switches and instruments missing) prices to sell. Write

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*Only slightly used—Equivalent of new*

10—40 KW Reliance VS Drives complete with enclosed floor mtg. control and 40/50 HP 400/1600 BB 230V motors. Total speed range 40 to 1600 RPM. Priced to sell quickly.

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Columbia City, Ind.

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250# PRESSURE Wickes 607 H P 300% RATING water tube boiler. GUARANTEED TO PRODUCE 50,000 POUNDS OF STEAM FOR 2 HOUR PERIODS. Riley super stoker 300% rating—Combustion Engineering Co. Elesco, superheaters, induced and force draft fans motor driven with controls—5 Vulcan soot blowers—All valves on boilers. All trims such as pressure guages, water columns etc. Steel structural supports—Copes feed water regulator and other items—Will sell this boiler with or without stoker or fans

**PURCHASED AS A SPARE IN 1930 USED ABOUT 3 YEARS, LAST INSPECTION REPORT (MARCH 1945) ALLOWS 250 lbs. PRESSURE, HAS NOT BEEN USED SINCE.**

Boiler and accessories have been taken out and are now stored in New York City

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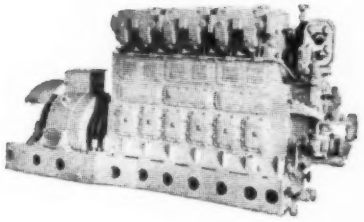

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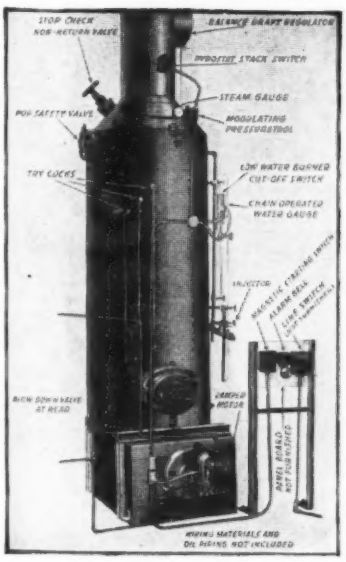


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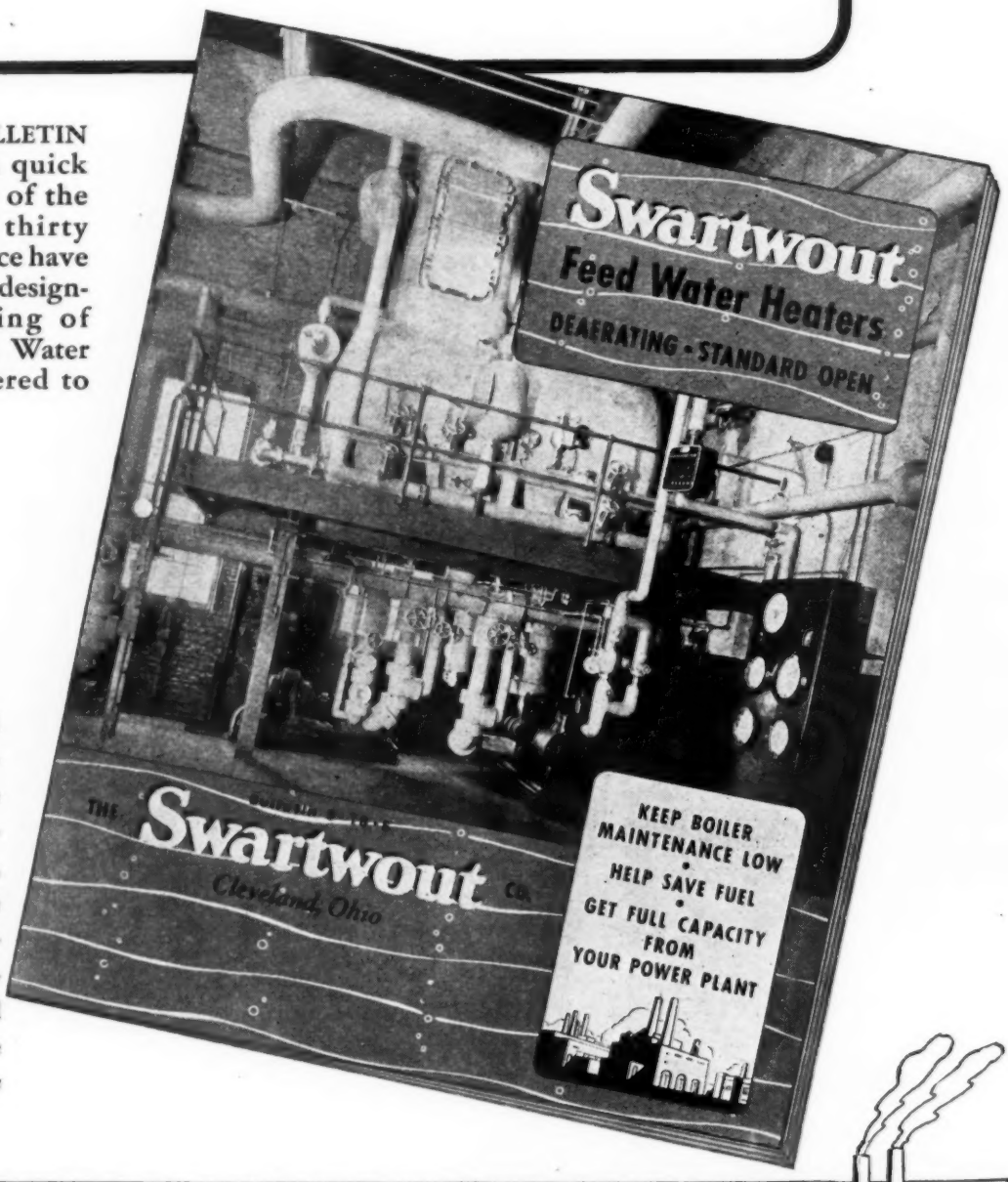
*Send for the facts about...* **Swartwout Feed Water Heaters**

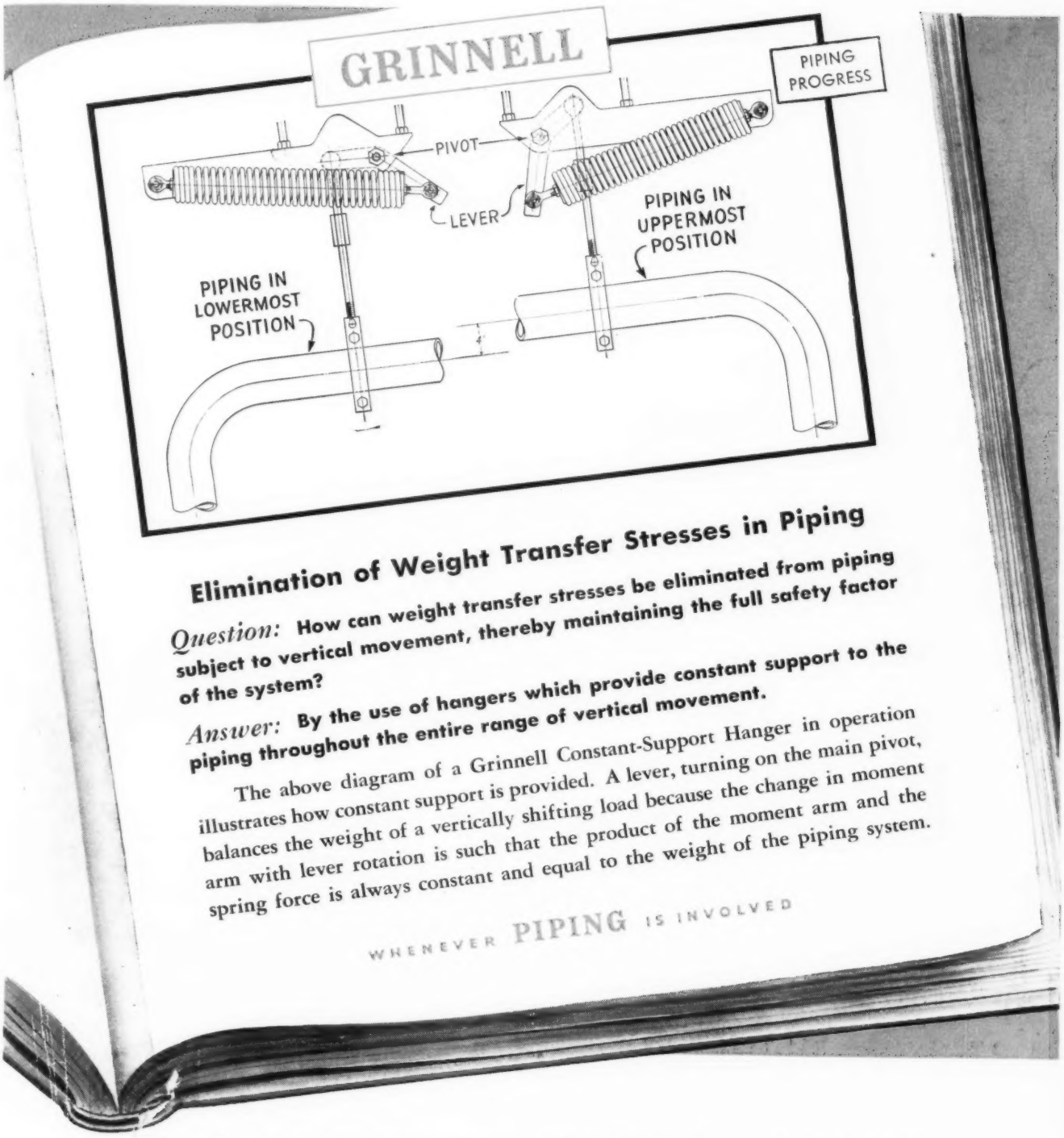
THIS NEW BULLETIN gives you in quick detail the story of the high efficiency thirty years of experience have brought to the designing and building of Swartwout Feed Water Heaters engineered to your needs.




● Prevent corrosion and reduce costly maintenance — save valuable fuel by efficient preheating. Swartwout Heaters, engineered to handle *your* feed water requirements, meet all tests, assure definite savings and life-time trouble-free service. *Write for Bulletin S-18-E today.*

**Swartwout** POWER PLANT EQUIPMENT

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio




## Elimination of Weight Transfer Stresses in Piping

*Question:* **How can weight transfer stresses be eliminated from piping subject to vertical movement, thereby maintaining the full safety factor of the system?**

*Answer:* **By the use of hangers which provide constant support to the piping throughout the entire range of vertical movement.**

The above diagram of a Grinnell Constant-Support Hanger in operation illustrates how constant support is provided. A lever, turning on the main pivot, balances the weight of a vertically shifting load because the change in moment arm with lever rotation is such that the product of the moment arm and the spring force is always constant and equal to the weight of the piping system.

WHENEVER PIPING IS INVOLVED

The designing and production of pipe hangers to meet the varied requirements caused by expansion, contraction, pressure, vibration and load call for a thorough working knowledge of springs, levers and other mechanical devices as well as of pipe and piping systems. As a result of 95 years of piping experience and continuous laboratory research and experimentation, Grinnell is able to offer standard and special-purpose hangers to meet every conceivable requirement in piping.

Whenever piping is involved – Grinnell has the specialized engineering knowledge to handle the job – from first plan to actual operation. Grinnell can supply everything from a tiny tube fitting to a complete power plant installation.

GRINNELL COMPANY, INC. Executive Offices, Providence 1, R. I. Branch warehouses in principal cities. Manufacturing Plants: Providence, R. I.; Cranston, R. I.; Atlanta, Ga.; Warren, Ohio; Columbia, Pa.

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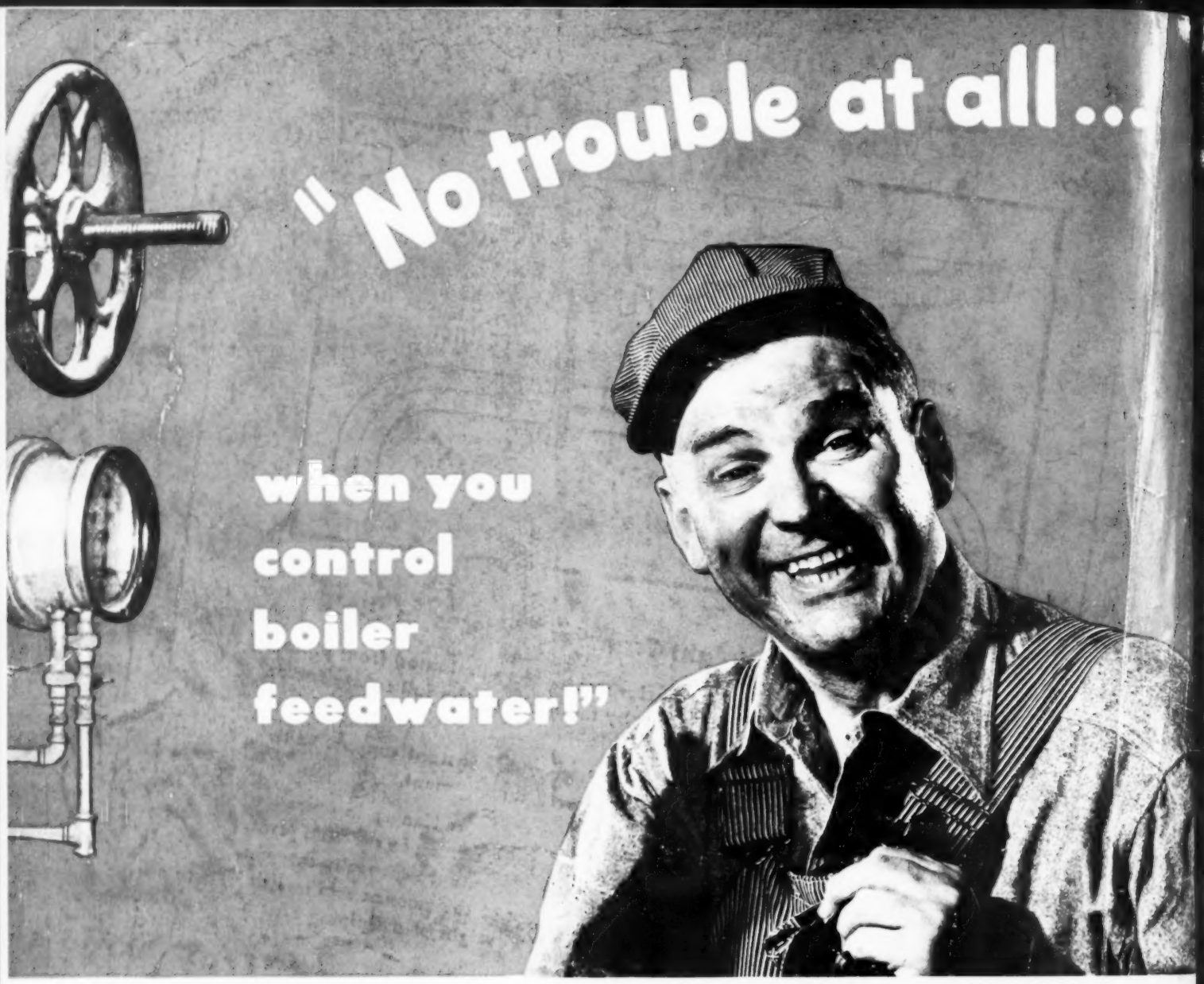
WHENEVER **PIPING** IS INVOLVED



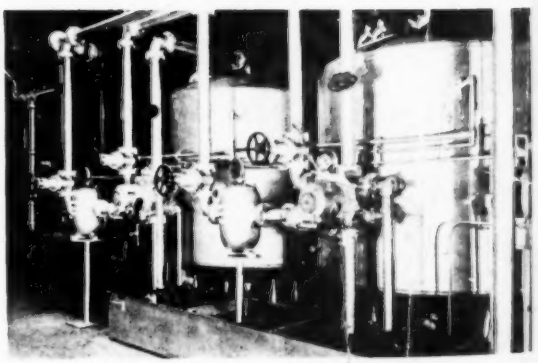

# How Permutit helps prevent boiler scale and corrosion

There's no chance for impurities in feedwater to cause scaling, corrosion of boilers and steamlines—and even more serious trouble—if a plant is Permutit* protected. Permutit *removes* these impurities before the water enters the boilers!

Manufacturers of water conditioning equipment for over 30 years, Permutit provides *every* process for control of water quality—Zeo-Karb Water Softeners (illustrated), Hot and Cold Lime Soda Softeners, Deaerating Heaters as well as Continuous Blowoff and Demineralizers that deliver a low-cost substitute for evaporated water.

It's no trouble at all to keep boilers *clean as new metal*—with Permutit Water Conditioning. Write, outlining your water problem, to The Permutit Company, Dept. P 3,330 West 42nd Street, New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.



**PERMUTIT ZEO-KARB* H WATER CONDITIONER** removes both hardness and bicarbonates from water. Effluent contains no incrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H Unit and a sodium zeolite unit.

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# PERMUTIT

**Manufacturers of ALL types of water treatment equipment**

**It's good business to begin with Good Water**

WATER CONDITIONING HEADQUARTERS